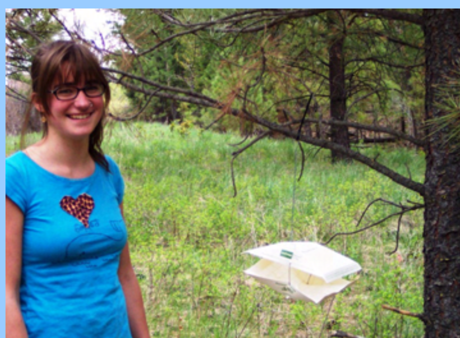
MONTANA DEPARTMENT OF AGRICULTURE COOPERATIVE PEST SURVEY REPORT 2008



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USDA Forest Service
Montana Department of Natural Resources & Conservation
Montana State University

2008 Surveys

- **Gypsy Moth-GM & RGM**
- **Karnal Bunt-KB**
- **Nematodes-PCN**
- **Emerald Ash Borer-EAB**
- **Exotic Moths-SSM, SFT, LBAM**
- **Cereal Leaf Beetle-CLB**
- **Cereal Leaf Beetle Biological Control**
- **Exotic Wood Boring Insects-EWBB**

This report was compiled by Patricia Denke, Michele Mettler, and Ian Foley, with contributions from our survey interns.

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Introduction to the Program

The Cooperative Agricultural Pest Survey (CAPS) is a nationwide survey effort initiated by the USDA Animal Plant Health Inspection Service (APHIS) Plant Protection and Quarantine (PPQ), to detect and/or monitor the spread of introduced plant pests. To achieve this goal, the USDA APHIS PPQ enlists the assistance of state cooperators. In Montana, state cooperators are coordinated through the Montana Department of Agriculture, and include not only the Department of Agriculture, but also Montana State University, the Montana Department of Natural Resources and Conservation, and the US-Forest Service.

The Interns and Other Program Assistants

The Montana Department of Agriculture conducts several of the surveys. This would not be possible without the assistance of a group of dedicated people, who join the department for the summer as interns and survey technicians. We also had the invaluable assistance of Margaret Rayda, Pest Survey Specialist for North Dakota and Montana with the USDA-APHIS-PPQ and Amy Gannon, Forest Entomologist with MDNRC .

Interns for 2008 included Jamie Hollett, Kelsey Redmond, and April Wabeke. Jamie, originally from Maryland and currently an Animal Science major at MSU-Bozeman, focused on the Emerald Ash Borer survey and the Exotic Wood Boring Insect Survey. Kelsey, from Helena and currently an Environmental Science major at UM-Missoula, focused on exotic moth trapping primarily west of the continental divide. April, from Kevin, Montana, concentrated first on the Cereal Leaf Beetle survey and its bio-controls and then on the Karnal Bunt survey

In addition to the interns, we had the assistance of Shane Delzer as a technician. Shane is a recent graduate of Capital High in Helena, and will be attending MSU-Bozeman in the fall. He provided trap and field support to a variety of surveys, as well as assisted with sorting insects, data entry and management, and public outreach.

Cereal Leaf Beetle Detection Survey
Oulema melanopus (L.)

Cereal leaf beetle (CLB), pictured below, is an exotic quarantine pest of forage and cereal grains. It is commonly found on small grains, particularly wheat, barley, and oats. The adults and immatures feed on the developing plants, at times causing extreme defoliation.

Image from http://www.padil.gov.au

Adult cereal leaf beetle.
Approximate length 1/8 to 1/4 inch long.

During 2008, as in the past, routine surveys were conducted for CLB. Up to 5 samples were taken in each of the 30 surveyed counties, with a sample consisting of two sets of 50 sweeps with a 15-inch sweep net. When choosing fields to sample, preference was given to spring planted grains.

Cereal leaf beetles were found in 4 Montana counties during the 2008 sampling season. Counties that had been found positive for CLB in the past were not necessarily sampled during 2008. In total, 48 of Montana's 56 counties have had CLB detections since the discovery of the pest in the late 1980's. There were no noted range expansions for this pest during 2008 and the counties that remain free of CLB based on official survey are: Glacier, Liberty, Hill, Phillips, Valley, Daniels, Sheridan, Roosevelt, and Fallon.

Cereal Leaf Beetle Parasitoids
Tetrastichus julis (Walker) & *Anaphes flavipes* (Förster)

The Cereal leaf beetle has spread across much of Montana during the past two decades. While initial movement was accompanied by severe outbreaks and economic damage, in more recent years the outbreaks have not been as severe. This may be, in part, due to the nature of the newly

infested areas, which are generally drier and therefore less hospitable to the immature beetles. It may also be due to the presence of two parasitoids released by the United States Department of Agriculture, Animal & Plant Health Inspection Service, Plant Protection & Quarantine (USDA APHIS PPQ) to assist in the management of this pest.

The first of these parasitoids to be released and recovered was *Tetrastichus julis*, an internal parasitoid of the CLB larva. The larvae of *T. julis* are maggot-like and bright orange in color. In some samples 100 percent of CLB larvae contained parasitoids, although this varies not only from place to place but also from day to day in the same place. Data suggest that this parasitoid is capable of movement as rapidly as CLB. CLB larvae were only collected at 4 sites with parasitism rates by *T. julis* ranging between 25-100%, and an average overall rate of 54%.

The second parasitoid, *Anaphes flavipes*, is an egg parasitoid. Although this insect has been released at several Montana locations, the exact status has been more difficult to assess. This is due partially to the small size of the insect, and partially to the fact that CLB eggs are prone to desiccation, making it more difficult to determine when mortality was due to the parasitoid versus other causes. Based on previous year's data and recommendations from the Western Region CLB working group, this parasitoid was not a part of the official survey conducted by the MDA in 2008.

Image, Claude Pilon, www.buguide.net

CLB larva parasitized by *T. julis*.

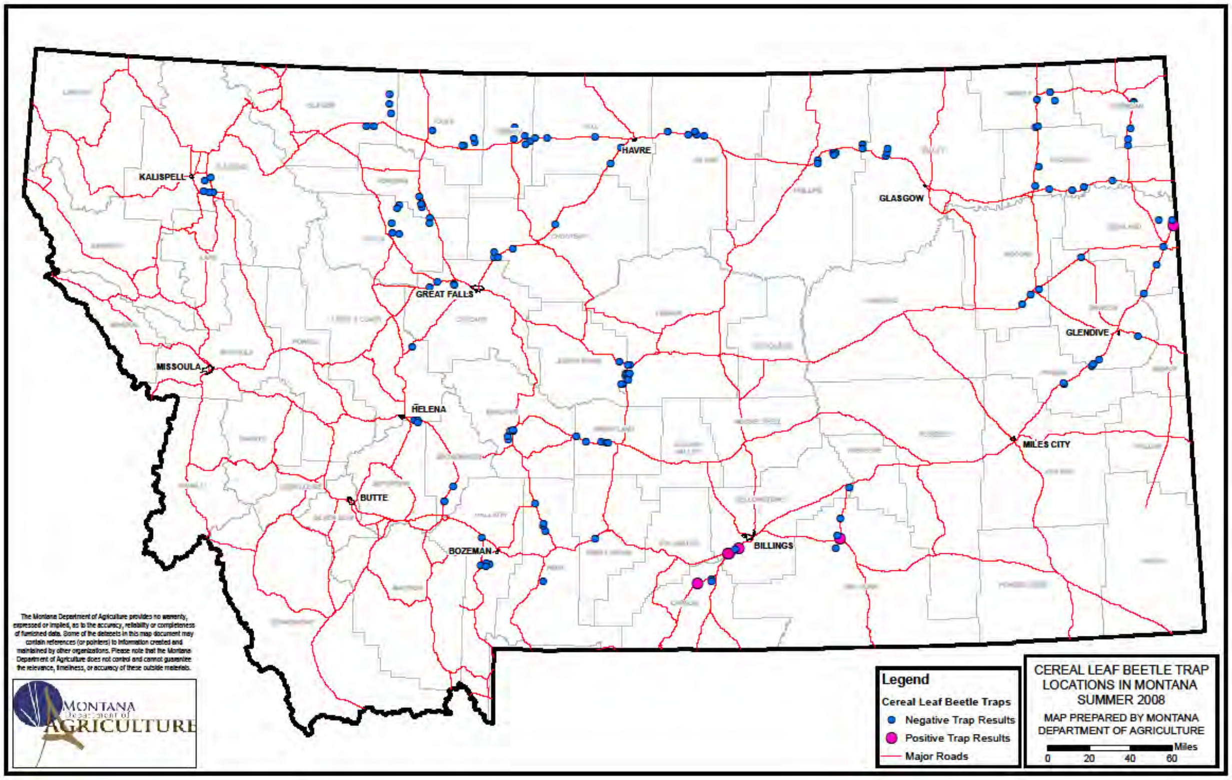
2008 sites surveyed for the presence of CLB and *Tetrastichus julis* (Walker)

COUNTY	Total # Samples	POS.	NEG.	*T. julis* Recovered
BIG HORN	4	1	3	NO
BLAINE	5	0	5	NO
CARBON	3	1	2	NO
CASCADE	5	0	5	NO
CHOUTEAU	5	0	5	NO
DANIELS	5	0	5	NO
DAWSON	5	0	5	NO
FERGUS	5	0	5	NO
FLATHEAD	5	0	5	NO
GALLATIN	5	0	5	NO
GLACIER	5	0	5	NO
HILL	5	0	5	NO
JUDITH BASIN	5	0	5	NO
LEWIS AND CLARK	5	0	5	NO
LIBERTY	5	0	5	NO
MCCONE	3	0	3	NO
MEAGHER	5	0	5	NO
PARK	6	0	6	NO
PHILLIPS	5	0	5	NO
PONDERA	5	0	5	NO
PRAIRIE	2	0	2	NO
RICHLAND	7	1	6	YES
ROOSEVELT	6	0	6	NO
SHERIDAN	5	0	5	NO
SWEETGRASS	1	0	1	NO
TETON	5	0	5	NO
TOOLE	5	0	5	NO
VALLEY	5	0	5	NO
WHEATLAND	5	0	5	NO
YELLOWSTONE	6	3	3	YES
TOTAL	**143**	**6**	**137**	**2**

RESULTS: Cereal leaf beetle was found at 6 sites in four counties, Big Horn, Carbon, Richland, and Yellowstone. Larvae parasitized by *Tetrastichus julis* were recovered at two sites, one each in Richland and Yellowstone counties.

CLB Survey History

County	Year CLB found	Year T.j. first recovered	Year A.f. first recovered
YELLOWSTONE	1989	1995	1993
STILLWATER	1989	1997	1994
CARBON	1989	1995	1993
BIG HORN	1991	1997	1997
PARK	1993		
SWEET GRASS	1993	2005	
STILLWATER	1993	1997	1994
GOLDEN VALLEY	1993		
MUSSELSHELL	1993		
TREASURE	1993	1997	1998
ROSEBUD	1993	1998	1998
CUSTER	1994	1998	1998
GALLATIN	1995	1997	
POWDER RIVER	1995		
PRAIRE	1995		
DAWSON	1995	2007	
GARFIELD	1996		
RICHLAND	1996	2004	
RAVALLI	1997	1997	
BROADWATER	1997	1998	
FERGUS	1997		
CARTER	1997		
LINCOLN	1998		
FLATHEAD	1998	1999	
LAKE	1998	2000	2004
SANDERS	1998		
MISSOULA	1998	2000	
GRANITE	1998		
LEWIS AND CLARK	1998	1998	
JEFFERSON	1998	2004	
MADISON	1998		
PETROLEUM	1998		
TETON	1999	2005	
CASCADE	1999		
POWELL	1999		
DEER LODGE	1999		
SILVER BOW	1999		
MCCONE	1999	1998	
BEAVERHEAD	2000		
PONDERA	2000	2004	
CHOUTEAU	2000		
JUDITH BASIN	2000		
MEAGHER	2000	2004	
TOOLE	2004	2004	
WHEATLAND	2004		
BLAINE	2005	2005	
WIBAUX	2006	2007	
FALLON	NOT FOUND	2007	

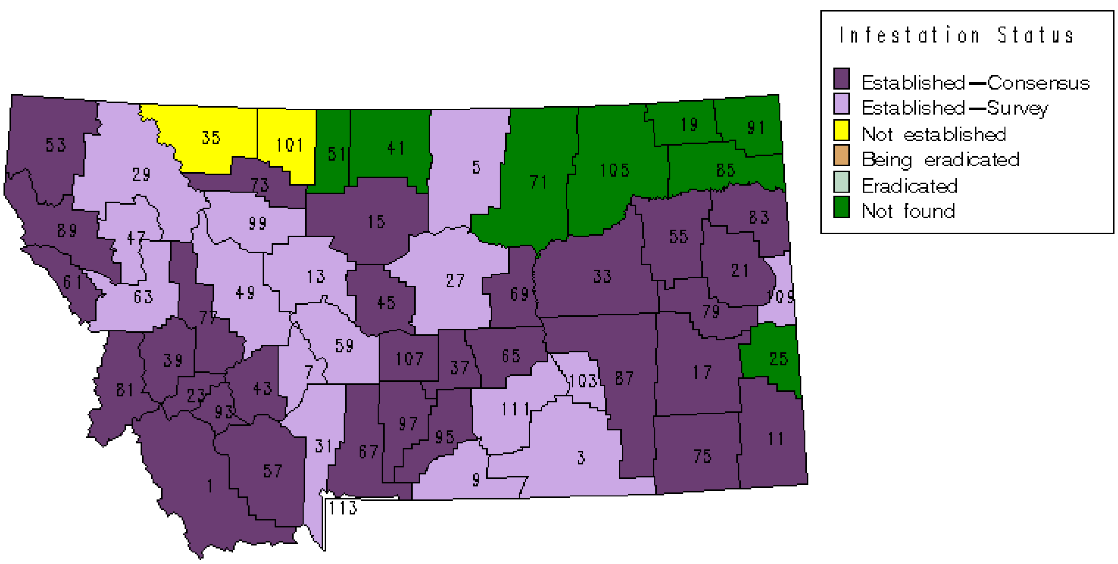


Reported Status of

Cereal Leaf Beetle (Clb) , Oulema melanopus

in MONTANA

Data retrieved from National Agricultural Pest Information System on 08/25/2008



The Center for Environmental and Regulatory Information Systems does not certify the accuracy or completeness of the map.

Gypsy Moth (GM) Detection Survey
Lymantria dispar (L.)

Gypsy moth (*Lymantria dispar* (L.)) was initially introduced into the Eastern U.S in the mid 1800's. It established rapidly and became a serious defoliating pest of various deciduous trees. The females oviposit on various surfaces, covering the eggs with hairs or scales. This insect is frequently moved on a variety of objects, such as RV's, firewood, furniture and other recreational equipment that has been left outdoors. The gypsy moth is the most destructive forest pest in the Eastern United States and large areas of the Northeastern US are under a federal quarantine to prevent the spread of this pest.

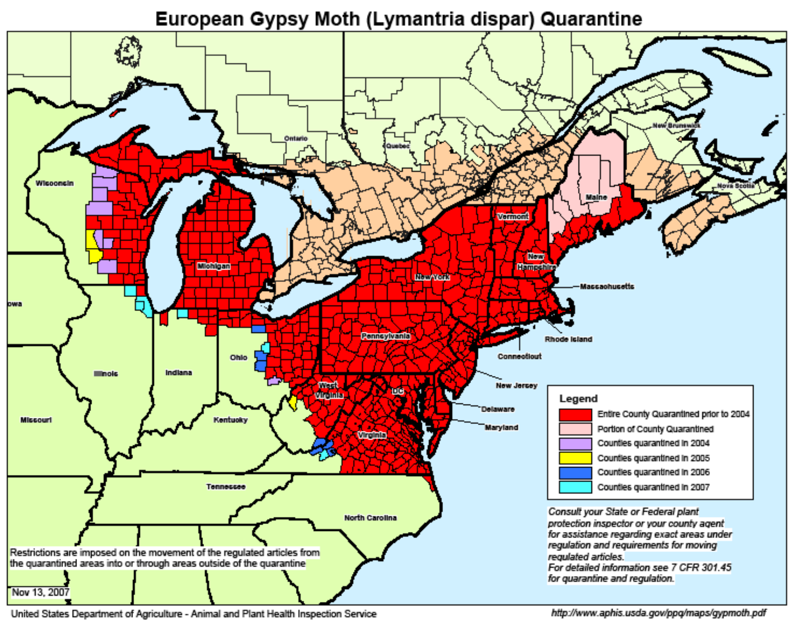


Image from http://www.padil.gov.au

Male Gypsy Moth

Traps are baited with a female sex-pheromone and only attract males.

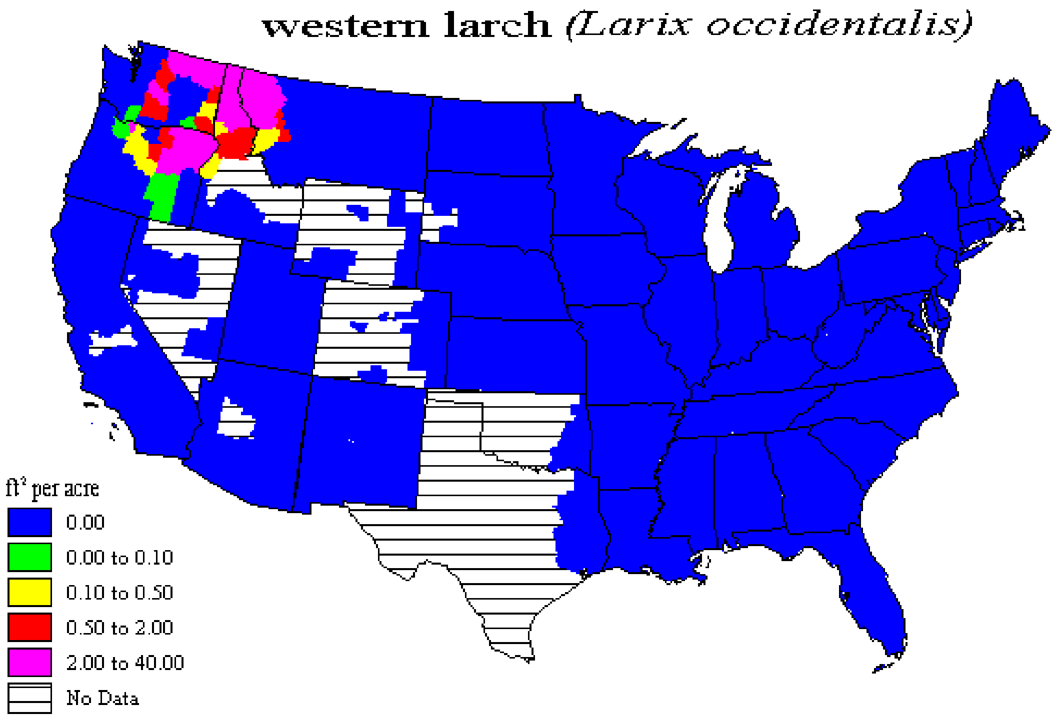
Larvae are voracious predators and feed on over 500 different species of plants. Important potential native tree hosts of the Gypsy Moth in Montana include Aspen and Western Larch. Older larvae will also actively feed on Pines and Spruce. Many landscape and urban trees and shrubs across Montana would be subject to GM defoliation. There have been several positive GM traps in Montana in recent years: Cascade (1989, 1990), Gallatin (1988), Glacier (2001, 2003, 2007), Lewis and Clark (1988), Liberty (1992), Missoula (1996), Park (2001), and Yellowstone (1993). All of these moths were certainly moved through anthropogenic means and this human caused movement of immobile egg masses and pupae represents the most significant entry pathway of the Gypsy Moth into Montana.

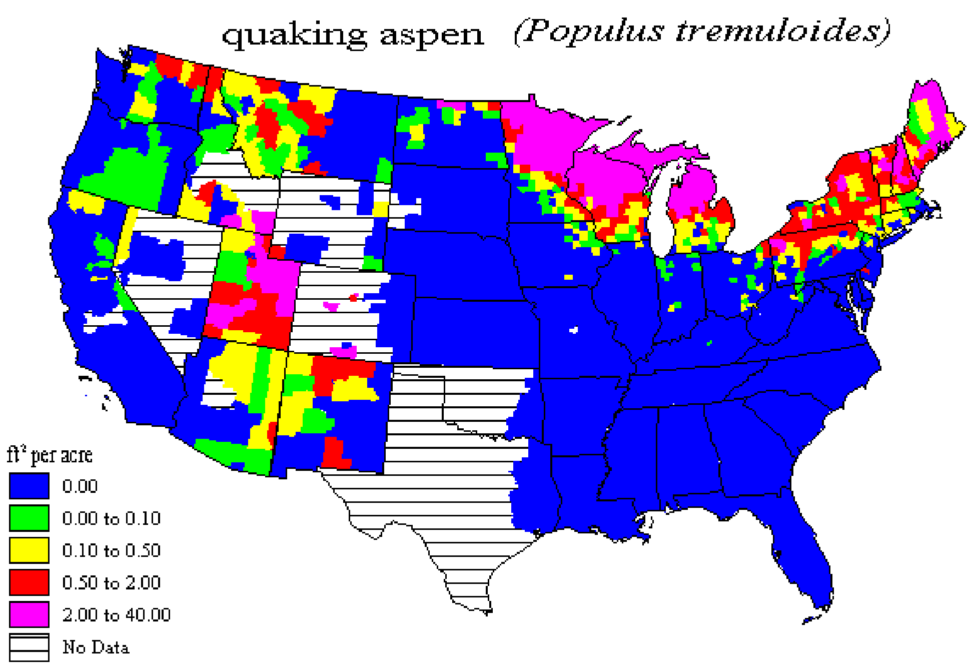
Major native Montana host plants are generally concentrated in the Western half of the state (see Western larch and quacking aspen distribution maps below), but suitable landscape and urban gypsy moth host plants can be found across Montana.

In Montana, responsibility for the trapping of gypsy moth is a multi-agency cooperative effort between the USDA APHIS PPQ, The Montana Department of Agriculture (MDA), The Montana Department of Natural Resources & Conservation (DNRC), and the USDA Forest Service (USDA FS). The USDA APHIS PPQ is responsible for trapping in mainly the eastern portion of the state, while the MDA traps mainly in the western part of the state. The DNRC sets traps in Mineral and Missoula Counties and the USDA-FS sets traps in a large number of campgrounds, as well as other public recreation areas. All traps were placed by early June, and checked throughout the summer at two to three week intervals.

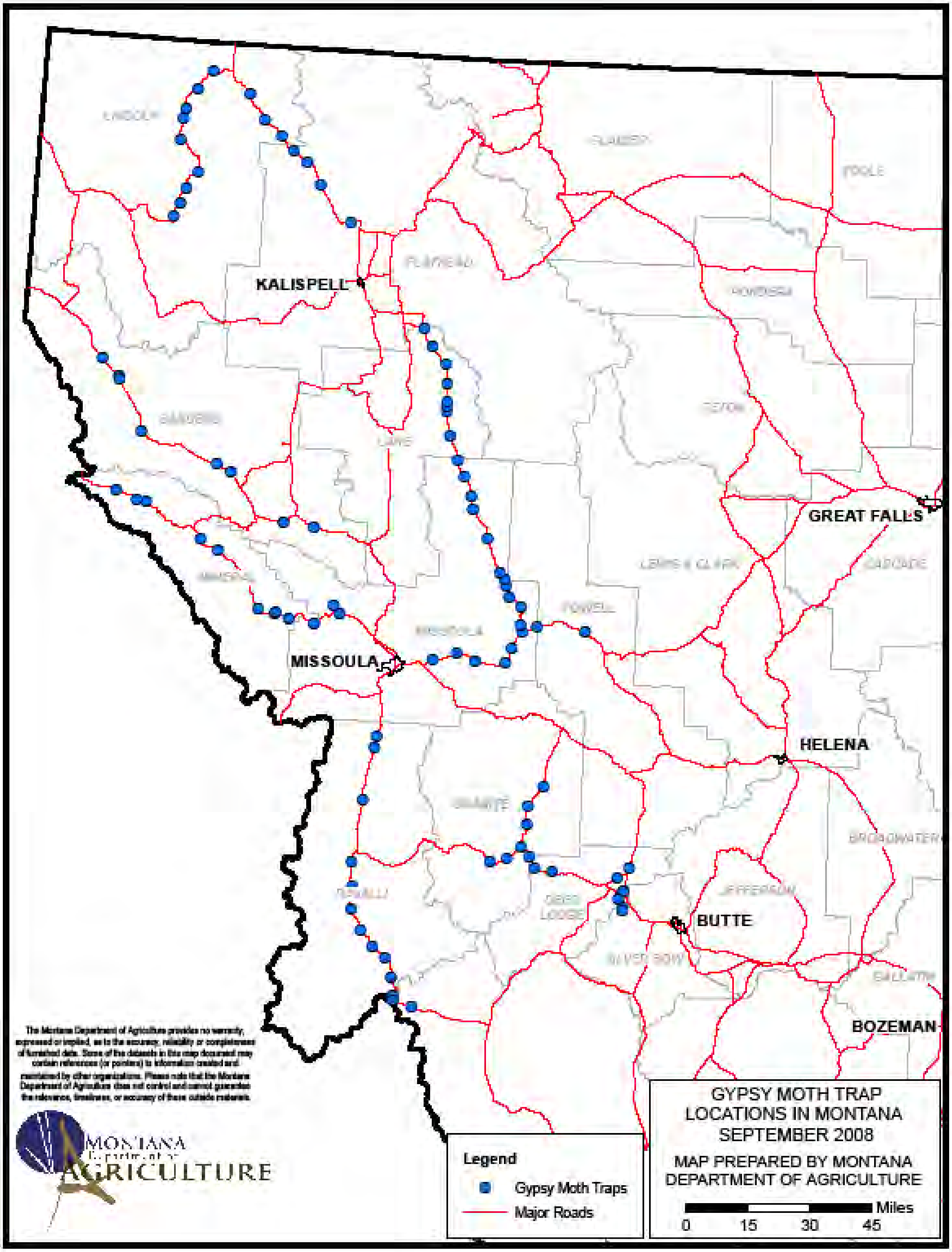
RESULTS: 135 GM traps were placed by MDA personnel in 2008, and no suspect moths were found.

Potentially important native Montana host plants of the Gypsy Moth





Locations of gypsy moth traps placed in Montana by MDA



2008 MDA GYPSY MOTH TRAPS BY COUNTY	
Total Number of Traps	**County**
5	POWELL
20	MISSOULA
8	LAKE
13	RAVALLI
7	GRANITE
9	DEER LODGE
2	SILVER BOW
10	MINERAL
15	SANDERS
23	LINCOLN
18	FLATHEAD
5	LAKE
135	**Total**

Kelsey Redmond placing a Gypsy Moth delta-trap in Powell County near a fishing access and campground.

Rosy Gypsy Moth (RGM) Detection Survey
Lymantria mathura Moore

Both the gypsy moth and the rosy gypsy moth are members of the moth family Lymantridae. This family includes several native tussock moth forests pests and many members of the family are serious plant defoliators.

Images from http://www.padil.gov.au

Female (left) and male (right) Rosy Gypsy Moth

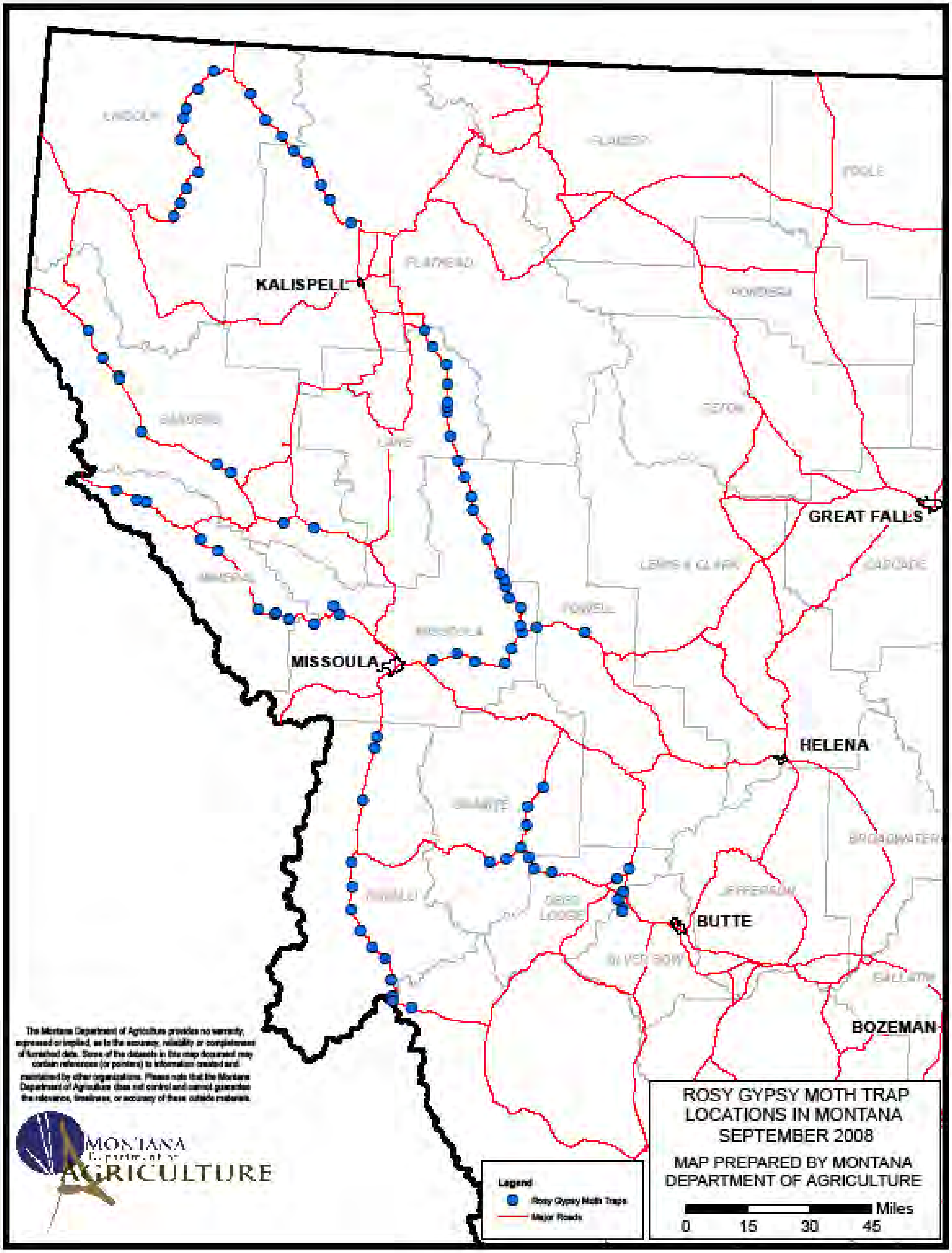
Rosy gypsy moth larvae are polyphagous and feed on a diverse range of deciduous trees. Hosts include oaks, willows, fruit trees, birches, and ashes. Larvae can feed on some conifers, but those hosts are generally not preferred and result in lower levels of survivorship. This moth is native to China, Bangladesh, India, Japan, Korea, Pakistan, Taiwan, and the Russian far East and is not established anywhere in North America.

The surveys for both gypsy moths were linked because of sampling location and high risk area similarities. The rosy gypsy moth and other exotic moths in the CAPS surveys are considered to have a higher risk of introduction in the western portion of the state, and also to pose a higher risk to that area should they be introduced.

2008 MDA ROSY GYPSY MOTH TRAPS BY COUNTY	
Total Number of Traps	**County**
5	POWELL
20	MISSOULA
8	LAKE
13	RAVALLI
7	GRANITE
9	DEER LODGE
2	SILVER BOW
10	MINERAL
12	SANDERS
26	LINCOLN
18	FLATHEAD
5	LAKE
135	**Total**

RESULTS: No Rosy Gypsy Moths or suspects were trapped by MDA personnel in 2008.

Locations of rosy gypsy moth traps placed in Montana by MDA



Siberian Silk Moth (SSM) Detection Survey
***Dendrolimus sibiricus* (Tschetverikov)**

The Siberian silk moth is a polyphagous defoliator of conifers. Laboratory tests in the US have indicated that Douglas-Fir would be a highly preferred host in the Western states. In its native range, Russia, Kazakhstan, North and South Korea and Mongolia, SSM is responsible for damage similar to that done by the European gypsy moth in outbreak areas of Eastern North America.

Image from http://www.padil.gov.au

SSM adult male

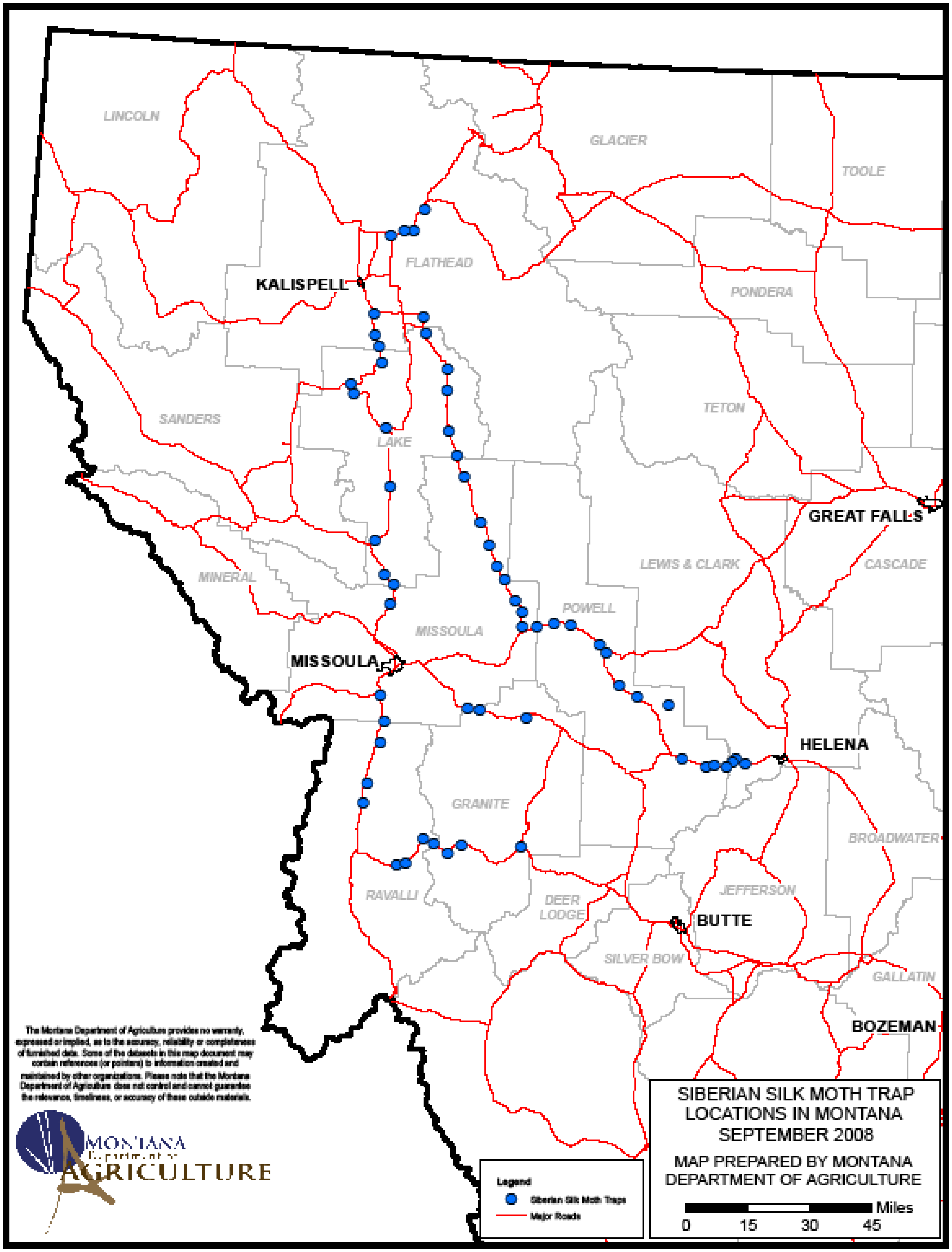
If established in Western North America, the impact on forest health would probably be greater than that of the gypsy moth on Northeastern forests because conifers are more prone to mortality when repeatedly defoliated. Infestations can lead to slower forest growth, tree death in cases of repeated infestation, and unsightly forests that are not attractive for recreation, thus reducing tourism a potentially large issue in Montana and other western states . Trapping for this moth involves green Gypsy Moth milk carton traps that are modified to capture a larger moth (40-80mm).

Shane Delzer placing a SSM trap the first week of July in Ravalli Co.

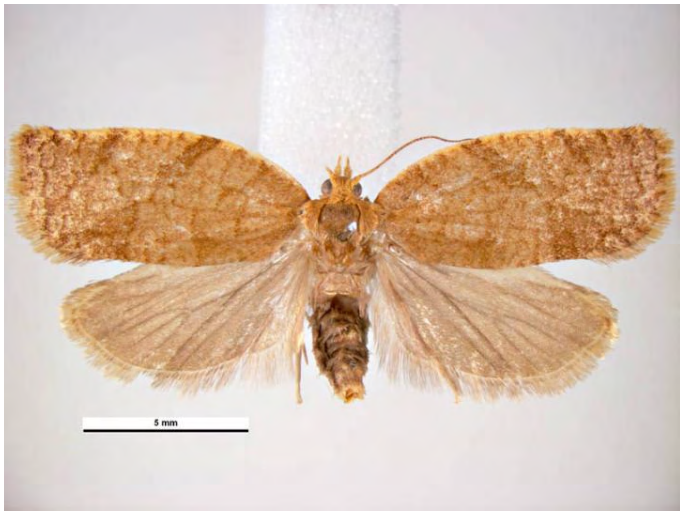
RESULTS:
A total of 60 SSM traps were placed in the following counties; Lewis and Clark, Powell, Missoula, Lake, Flathead, Granite, and Ravalli. No Siberian Silk Moths or suspects were trapped or submitted. The most commonly collected moth in the SSM traps was the forest tent caterpillar, *Malacosoma californicum* (Packard) (image below *Malacosoma* sp.).

Western forest tent caterpillar

Locations of Siberian silk moth traps placed in Montana



Summary Fruit Tortrix (SFT) Detection Survey
Adoxophyes orana (Fischer von Röslerstamm)



Images from http://www.padil.gov.au

Adult female SFT

The summer fruit tortrix (*Adoxophyes orana*) can be a serious pest of most fruits, but particularly apples and related fruits. While Montana does not have a large fruit industry, this is a section of the economy that has potential for growth. The growth of the Montana fruit industry is dependent on the management of native pest populations and the exclusion of new exotic pests. Besides fruit trees, this pest feeds on many plants, including roses and other ornamentals. This survey was conducted using Pherocon® Wing Traps baited with a species specific pheromone. Traps were placed in high risk fruit growing regions of Western Montana.

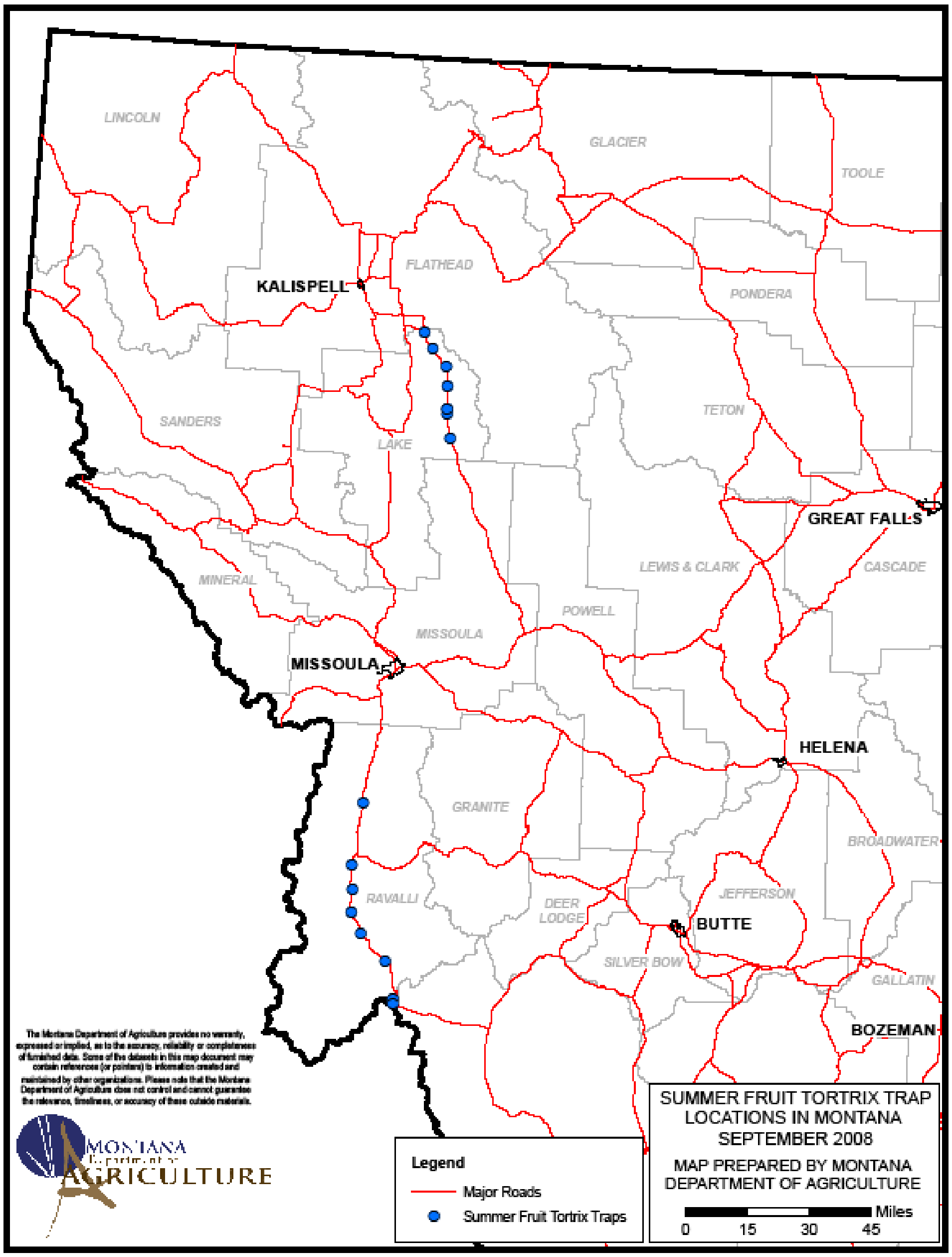
Images by R. Coutin/OPIE

SFT damage

RESULTS: No summer fruit tortrix moths were trapped and no suspect moths were submitted.

2008 MDA SUMMER FRUIT TORTRIX TRAPS BY COUNTY	
Total Number of Traps	**County**
47	LAKE
8	RAVALLI
11	FLATHEAD
66	**Total**

Locations of summer fruit tortrix moth traps placed in Montana



Karnal Bunt Detection Survey
Tilletia indica Mitra

Karnal Bunt (KB) is a fungal disease that affects wheat, durum wheat and triticale. Initially, the disease was discovered near Karnal, India in 1931. KB was first detected in the United States in 1996, within the state of Arizona in durum wheat seed. Subsequently, the disease was found in portions of Southern California and Texas. The disease has never been detected in Montana. KB thrives in cool, moist temperatures as the wheat is starting to head out.

Karnal Bunt spores are windborne and can spread through the soil. Spores have the ability to survive within the soil for several years. Grain can also become contaminated by equipment. Therefore, controlling the transportation of contaminated seed is essential in preventing the spread to major Montana production areas. In addition, early detection is essential if any type of control or eradication is to be attempted. Montana's participation in the annual karnal bunt survey is part of the early detection grid set out across the United States.

Credits: R. Duran, Washington State University www.forestryimages.org

Bunted Wheat

Montana's Crop Production for 2007

ITEM	BUSHELS	RANK	% U.S. Total
All Wheat	**149,820,000**	**3**	**7.2**
Winter Wheat	**83,220,000**	**8**	**5.5**
Durum Wheat	**11,400,000**	**2**	**16.0**
Other Spring	**55,200,000**	**3**	**11.5**
Barley	**31,680,000**	**3**	**15.0**

http://usda.mannlib.cornell.edu/usda/current/CropProdSu/CropProdSu-01-12-2006.txt

RESULTS: Montana continued to sample for KB during the 2008 harvest. A total of 138 samples were collected from 30 counties across Montana. The USDA Laboratory in Olney, Texas conducted

the testing. All samples tested negative for the presence of KB. This sampling is critical for wheat growers in Montana. It confirms our wheat is free from KB, ensuring access to export markets.

2007 Montana Wheat Production and Number of KB Samples

County	Harvested Acres	Production Bushels	# KB Samples	County	Harvested Acres	Production Bushels	# KB Samples
Chouteau	496,600	22,728,000	20	Fallon	41,900	1,038,000	1
Hill	416,800	12,664,000	13	Flathead	16,500	1,016,000	1
Roosevelt	326,600	8,488,000	9	Stillwater	38,700	1,001,000	0
Sheridan	299,700	7,231,000	8	Rosebud	37,800	980,000	1
Fergus	163,300	6,353,000	6	Wibaux	36,600	928,000	1
Liberty	248,400	6,003,000	5	Wheatland	37,000	919,000	1
Cascade	136,900	5,741,000	5	Prairie	32,800	892,000	1
Pondera	179,700	5,736,000	5	Musselshell	33,800	837,000	0
Teton	150,500	5,577,000	5	Madison	11,700	688,000	0
Daniels	261,400	5,467,000	5	Lewis and Clark	17,900	673,000	0
Valley	272,900	5,435,000	7	Golden Valley	23,900	665,000	0
McCone	209,400	5,146,000	6	Lake	11,300	656,000	0
Blaine	182,200	4,853,000	5	Custer	24,500	642,000	0
Big Horn	114,700	4,390,000	4	Beaverhead	7,600	608,000	0
Toole	228,500	4,378,000	5	Powder River	16,300	520,000	0
Dawson	163,100	4,164,000	3	Treasure	7,300	390,000	0
Richland	156,100	4,066,000	4	Petroleum	13,500	390,000	0
Phillips	120,200	3,081,000	3	Meagher	11,200	280,000	0
Judith Basin	78,600	2,805,000	2	Park	8,800	263,000	0
Gallatin	53,100	2,698,000	3	Carbon	4,600	130,000	0
Yellowstone	86,000	2,523,000	2	Jefferson	2,800	79,000	0
Garfield	82,200	2,147,000	2	Missoula	1,200	54,000	0
Glacier	122,500	1,819,000	4	Sweet Grass	1,900	52,000	0
Broadwater	34,300	1,270,000	1	Ravalli	1,700	42,000	0
Carter	37,600	1,167,000	0	Sanders	500	18,000	0
				State Total	**5,063,100**	**149,691,000**	**138**

2008 National Karnal Bunt Survey of Wheat Grain					Results from USDA Lab, Olney, TX				
Sample No.	**State**	**County**	**Results**	**Date Read**	**Sample No.**	**State**	**County**	**Results**	**Date Read**
MT-101	MT	Big Horn	Negative	10/6	MT-170	MT	Hill	Negative	8/18
MT-102	MT	Big Horn	Negative	10/6	MT-171	MT	Hill	Negative	8/18
MT-103	MT	Big Horn	Negative	10/6	MT-172	MT	Hill	Negative	8/18
MT-104	MT	Big Horn	Negative	10/6	MT-173	MT	Hill	Negative	8/18
MT-105	MT	Blaine	Negative	8/8	MT-174	MT	Judith Basin	Negative	8/19
MT-106	MT	Blaine	Negative	8/8	MT-175	MT	Judith Basin	Negative	8/26
MT-107	MT	Blaine	Negative	8/8	MT-176	MT	Liberty	Negative	8/18
MT-108	MT	Blaine	Negative	8/8	MT-177	MT	Liberty	Negative	8/19
MT-109	MT	Blaine	Negative	8/8	MT-178	MT	Liberty	Negative	8/19
MT-110	MT	Broadwater	Negative	10/29	MT-179	MT	Liberty	Negative	8/26
MT-111	MT	Cascade	Negative	8/8	MT-180	MT	Liberty	Negative	8/26
MT-112	MT	Cascade	Negative	8/8	MT-181	MT	McCone	Negative	9/10
MT-113	MT	Cascade	Negative	8/8	MT-182	MT	McCone	Negative	9/10
MT-114	MT	Cascade	Negative	8/8	MT-183	MT	McCone	Negative	10/6
MT-115	MT	Cascade	Negative	8/11	MT-184	MT	McCone	Negative	10/8
MT-116	MT	Chouteau	Negative	8/8	MT-185	MT	McCone	Negative	10/29
MT-117	MT	Chouteau	Negative	8/11	MT-186	MT	McCone	Negative	10/29
MT-118	MT	Chouteau	Negative	8/8	MT-187	MT	Phillips	Negative	10/6
MT-119	MT	Chouteau	Negative	8/8	MT-188	MT	Phillips	Negative	10/6
MT-120	MT	Chouteau	Negative	8/8	MT-189	MT	Phillips	Negative	10/6
MT-121	MT	Chouteau	Negative	8/8	MT-190	MT	Pondera	Negative	8/18
MT-122	MT	Chouteau	Negative	8/8	MT-191	MT	Pondera	Negative	8/18
MT-123	MT	Chouteau	Negative	8/8	MT-192	MT	Pondera	Negative	8/18
MT-124	MT	Chouteau	Negative	8/11	MT-193	MT	Pondera	Negative	8/18
MT-125	MT	Chouteau	Negative	8/8	MT-194	MT	Pondera	Negative	8/18
MT-126	MT	Chouteau	Negative	8/8	MT-195	MT	Prairie	Negative	10/8
MT-127	MT	Chouteau	Negative	8/8	MT-196	MT	Richland	Negative	9/19
MT-128	MT	Chouteau	Negative	8/8	MT-197	MT	Richland	Negative	10/29
MT-129	MT	Chouteau	Negative	8/8	MT-198	MT	Richland	Negative	10/29
MT-130	MT	Chouteau	Negative	8/8	MT-199	MT	Richland	Negative	10/29
MT-131	MT	Chouteau	Negative	8/11	MT-200	MT	Roosevelt	Negative	9/5
MT-132	MT	Chouteau	Negative	8/11	MT-201	MT	Roosevelt	Negative	9/10
MT-133	MT	Chouteau	Negative	8/11	MT-202	MT	Roosevelt	Negative	9/19
MT-134	MT	Chouteau	Negative	8/11	MT-203	MT	Roosevelt	Negative	9/10
MT-135	MT	Chouteau	Negative	8/11	MT-204	MT	Roosevelt	Negative	9/19
MT-136	MT	Daniels	Negative	10/8	MT-205	MT	Roosevelt	Negative	10/8
MT-137	MT	Daniels	Negative	9/10	MT-206	MT	Roosevelt	Negative	10/6
MT-138	MT	Daniels	Negative	10/6	MT-207	MT	Roosevelt	Negative	10/8
MT-139	MT	Daniels	Negative	10/6	MT-208	MT	Roosevelt	Negative	10/8
MT-140	MT	Daniels	Negative	10/8	MT-209	MT	Rosebud	Negative	10/8
MT-141	MT	Dawson	Negative	9/5	MT-210	MT	Sheridan	Negative	9/10
MT-142	MT	Dawson	Negative	9/10	MT-211	MT	Sheridan	Negative	9/10
MT-143	MT	Dawson	Negative	10/8	MT-212	MT	Sheridan	Negative	9/10
MT-144	MT	Fallon	Negative	10/8	MT-213	MT	Sheridan	Negative	10/29
MT-145	MT	Fergus	Negative	8/26	MT-214	MT	Sheridan	Negative	10/6
MT-146	MT	Fergus	Negative	8/26	MT-215	MT	Sheridan	Negative	10/6
MT-147	MT	Fergus	Negative	8/26	MT-216	MT	Sheridan	Negative	10/6
MT-148	MT	Fergus	Negative	9/10	MT-217	MT	Sheridan	Negative	10/29
MT-149	MT	Fergus	Negative	9/5	MT-218	MT	Teton	Negative	8/11
MT-150	MT	Fergus	Negative	9/5	MT-219	MT	Teton	Negative	8/11
MT-151	MT	Flathead	Negative	10/29	MT-220	MT	Teton	Negative	8/18
MT-152	MT	Gallatin	Negative	10/29	MT-221	MT	Teton	Negative	8/18
MT-153	MT	Gallatin	Negative	10/29	MT-222	MT	Teton	Negative	8/19
MT-154	MT	Gallatin	Negative	10/29	MT-223	MT	Toole	Negative	8/18
MT-155	MT	Garfield	Negative	10/8	MT-224	MT	Toole	Negative	8/19
MT-156	MT	Garfield	Negative	10/8	MT-225	MT	Toole	Negative	8/26
MT-157	MT	Glacier	Negative	8/26	MT-226	MT	Toole	Negative	9/5
MT-158	MT	Glacier	Negative	9/10	MT-227	MT	Toole	Negative	9/19
MT-159	MT	Glacier	Negative	9/10	MT-228	MT	Valley	Negative	10/8
MT-160	MT	Glacier	Negative	9/19	MT-229	MT	Valley	Negative	10/8
MT-161	MT	Hill	Negative	8/8	MT-230	MT	Valley	Negative	10/8
MT-162	MT	Hill	Negative	8/8	MT-231	MT	Valley	Negative	10/8
MT-163	MT	Hill	Negative	8/8	MT-232	MT	Valley	Negative	10/6
MT-164	MT	Hill	Negative	8/8	MT-233	MT	Valley	Negative	10/6
MT-165	MT	Hill	Negative	8/8	MT-234	MT	Valley	Negative	10/6
MT-166	MT	Hill	Negative	8/8	MT-235	MT	Wibaux	Negative	10/8
MT-167	MT	Hill	Negative	8/11	MT-236	MT	Yellowstone	Negative	10/6
MT-168	MT	Hill	Negative	8/11	MT-237	MT	Yellowstone	Negative	10/6
MT-169	MT	Hill	Negative	8/11	MT-238	MT	Wheatland	Negative	10/6

Emerald Ash Borer (EAB) Detection Survey
Agrilus planipennis Fairmaire

The emerald ash borer (EAB) is an exotic and extremely damaging pest that attacks and kills ash trees (*Fraxinus* sp.). In hardwood forests of the Eastern United States, this beetle is a severe threat to native forest ecosystems, as well as urban landscape trees. While native ash in Montana and the Intermountain West is limited to riparian areas, ash is a very significant urban landscape tree. Due to its hardy nature and cold tolerances, green ash has been planted in some Montana neighborhoods at densities approaching 100%.

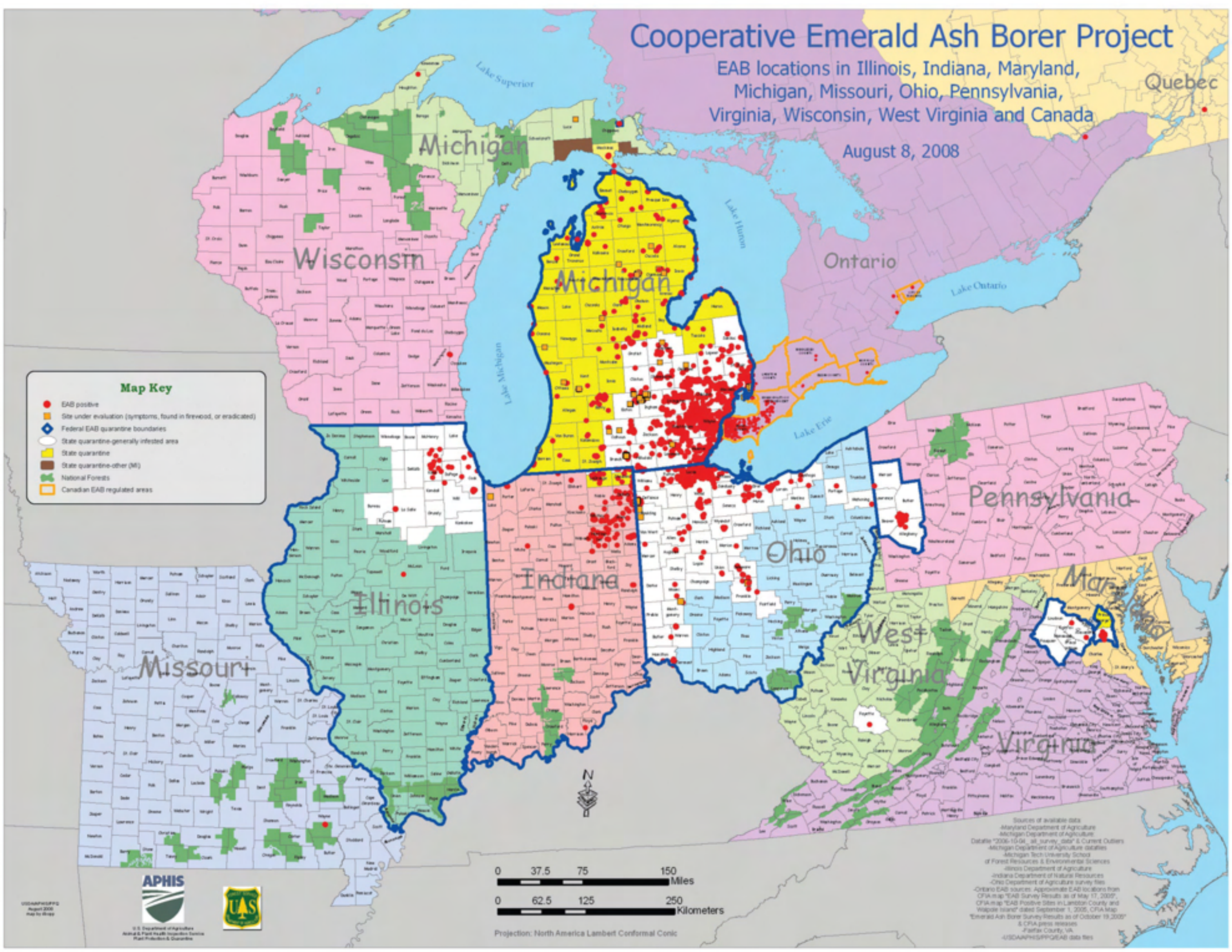
Emerald Ash Borer

The emerald ash borer is native to Asia, but was introduced into the Eastern United States sometime in the 1990's. EAB was first discovered in southeastern Michigan in 2002. It is suspected to have arrived in North America in solid wood packing materials (SWPM) used to ship commodities in the international market. Since 2002, EAB has been detected in Indiana, Illinois, Maryland, Michigan, Ohio, Pennsylvania, West Virginia, Wisconsin, and Missouri. EAB attacks and kills both healthy and stressed or dying trees, with the time from infestation to tree mortality being two to three years. It is estimated that EAB has killed 40 million ash trees in Michigan alone, with tens of millions more having been killed in other adjacent states.

Declining ash due to EAB damage. www.entomology.wisc.edu

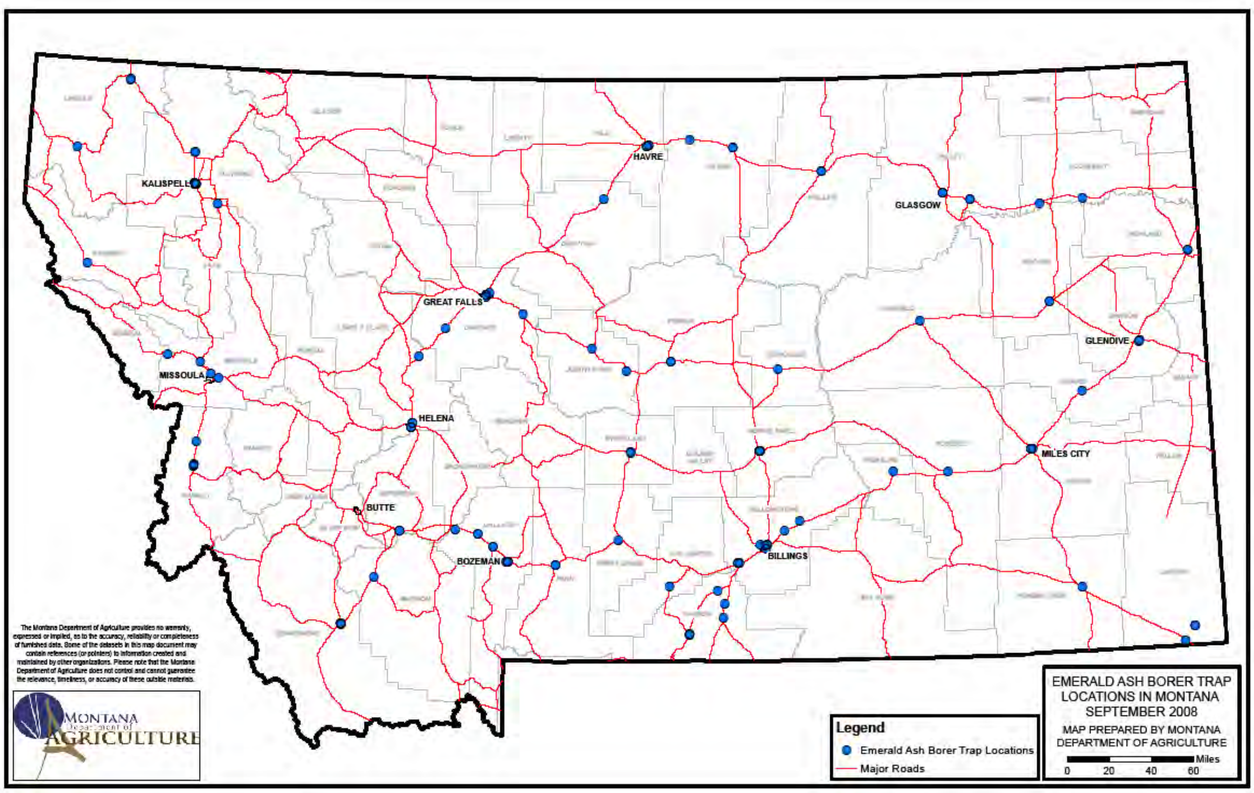
Emerald ash borer traps (image on left) are hung preferably in ash trees (*Fraxinus* sp.). The large purple trap that is sticky on the outside acts as a panel flight intercept trap, insects that fly into the panels become irremovably stuck in Tanglefoot®. The trap is baited with a Manuka Oil lure that mimics the plant volatiles released by a damaged ash tree.

The map below shows (red dots) the current positive finds of EAB. In 2008, EAB was newly confirmed in the states of Missouri and Wisconsin.



2008 MDA EMERALD ASH BORER TRAPS BY COUNTY			
# of Traps	**County**	**# of Traps**	**County**
3	LINCOLN	3	CARTER
3	MISSOULA	2	STILLWATER
2	JEFFERSON	6	CARBON
3	BEAVERHEAD	9	YELLOWSTONE
4	RAVALLI	1	TREASURE
8	GALLATIN	1	ROSEBUD
10	LEWIS AND CLARK	1	GARFIELD
6	CASCADE	2	McCONE
1	CHOUTEAU	1	PETROLEUM
4	HILL	2	FERGUS
3	BLAINE	2	WHEATLAND
2	PHILLIPS	1	GOLDENVALLEY
4	VALLEY	3	MUSSELSHELL
2	ROOSEVELT	1	SWEET GRASS
2	RICHLAND	2	JUDITH BASIN
3	DAWSON	1	BROADWATER
4	CUSTER	2	PARK
1	POWDER RIVER	10	FLATHEAD
		115	Total

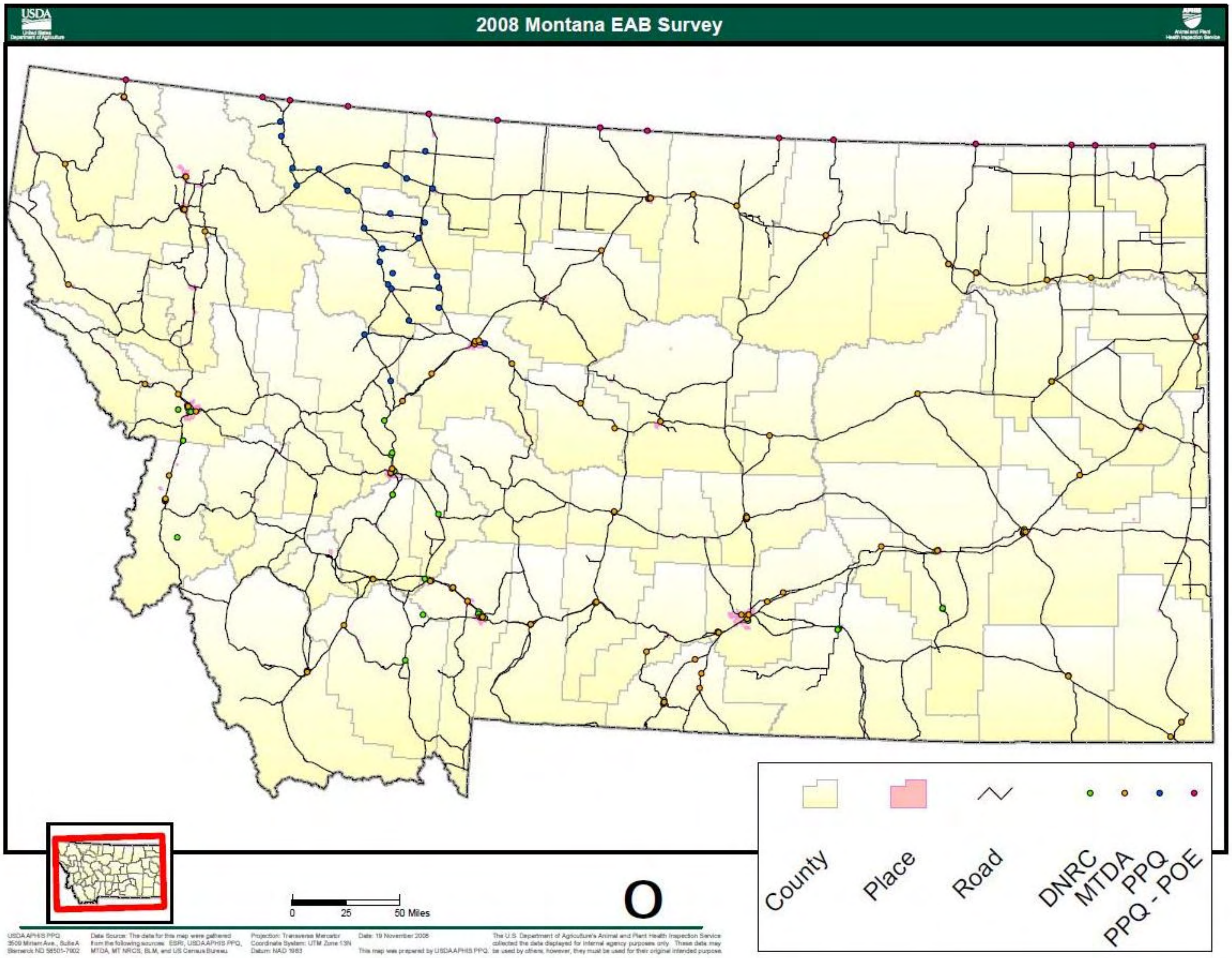
Locations of EAB traps placed in Montana by MDA



RESULTS: No suspect EAB were trapped in 2008 by MDA personnel. The native species *Agrilus politus* (Say) and *Agrilus anxius* Gory were both caught in EAB traps in 2008 and images of these two species are below.

***Agrilus politus* (Say), image by I. Foley.**

***Agrilus anxius* Gory, image by I. Foley.**



2008 Statewide Emerald Ash Borer Traps	
Agency	**Total Number of Traps**
MDA	115
DNRC	50
USDA-APHIS-PPQ	40
Total	**205**

EAB and Other Pest Outreach
Public Information Campaign

In order to start disseminating information about the possibly devastating impacts of the emerald ash borer, a door hanger campaign of plastic bags was conducted in Billings and Plentywood, MT. The APHIS plastic bags contained a variety of pest brochures related to EAB, JB, ALB, noxious weeds, and pesticide use in the home. Additional outreach materials included EAB pencils, DVD's, tattoos, magnets and balloons stating; HELP STOP INVASIVE SPECIES, "Burn it where you buy it", "Watch out for weeds", Montana Department of Agriculture-CAPS program.

There were 525 bags distributed in the Japanese beetle area of Billings and an additional 125 bags hung in the neighborhood around the hospital in Plentywood. Letters addressing EAB and JB were directed at homeowners to explain why the outreach was being conducted and are reproduced on the following two pages.

Dear Montana Resident,

In this bag, you will find information about an introduced wood boring beetle, the emerald ash borer (EAB), *Agrilus planipennis* Fairmaire. This insect has not been found in Montana, and we want to keep it that way.

EAB is native to Asia, but was FOUND in Michigan IN 2002. It attacks and kills healthy as well as stressed ash trees (*Fraxinus* sp.). To date, EAB has killed more than 30 million ash trees in southeastern Michigan alone, with tens of millions more lost in OTHER MIDWEST STATES.

One glance at a city park or down a town street in most Montana neighborhoods will show the potential risk of this pest. Ash trees are a dominant species in many of our urban landscapes and along streets across the state. The introduction of EAB could have an impact similar to Dutch elm disease, which virtually eliminated American elm as a component of the urban landscape.

The nearest tree known to have EAB is at least 1,000 miles from Montana, but this does mean it can't get here. Probably the most important path of entry for EAB is ash firewood cut in an infested area and moved in someone's RV or truck, stopping at all the campgrounds along their recreational route. At each stop, adult EAB could emerge, and infest nearby ash. As a result, the USDA started the “Don’t Move Firewood, It Bugs Me” campaign throughout the US. This program encourages recreationist and campers to "buy it where you burn it" to lower the risk spreading forest pests. Please follow this recommendation to help keep our forests and urban trees healthy.

Emerald ash borer may also move in nursery stock, including very small ash trees, and in wood materials. In addition, the adults are capable fliers, and can extend the leading edge of an infestation relatively rapidly.

To address the risks associated with the EAB, the US Department of Agriculture-Animal Plant Health Inspection Service (USDA-APHIS) and the Montana Department of Agriculture (MDA) have initiated a Cooperative Agricultural Pest Survey (CAPS) state wide, beginning in 2008. This program is designed to detect any possible EAB populations that may exist in the state and traps will be in many areas across the state that have a high risk of EAB introduction. EAB traps are large purple prisms that hang in trees: if you see one in your neighborhood please do not disturb the trap, as they are an extremely valuable first detection tool.

First detection is one of the keys to keeping Montana landscapes free of the “Green Menace.” If you see declining or dying ash trees in your neighborhood, notify your local forestry official, Montana Department of Agriculture representative, or Extension Agent.

LETS ALL WORK TO KEEP MONTANA ASH (AND OTHER TREES) HEALTHY, NOW AND IN THE FUTURE.

Dear Billings Resident,

Please find the enclosed information and outreach materials related to the Japanese beetle and other pests of concern to Montana. The Japanese beetle (JB), *Popillia japonica* Newmann, is an exotic pest that is HIGHLY DESTRUCTIVE to turf grasses as well as hundreds of species of fruit trees, ornamentals, shrubs, and field and vegetable crops.

The Japanese beetle was first introduced into the United States in 1916 and all states east of the Mississippi River are considered infested with this highly destructive pest. Efforts to control the larval and adult stages are estimated to cost more than $460 MILLION PER YEAR. Losses attributed to the larval stage alone, which cause significant damage to turf grasses, have been estimated at $234 million per year. This cost includes $78 million for control costs but and additional cost of $156 million to replace damaged turfs including lawns, golf course, and park grasses.

Overtime, and through its spread via commerce the Japanese beetle has been found in several isolated location throughout the Western US. Unfortunately, the Japanese beetle was reported in Montana in 2001 in the area around Billings Logan International Airport. A subsequent monitoring and eradication effort has been an ongoing cooperative project of the US Department of Agriculture-Animal Plant Health Inspection Service (USDA-APHIS), the Montana Department of Agriculture (MDA), MSU-Billings, and local homeowners. Japanese beetles have been detected in the Billings area every year since 2001, with the majority of positive traps found on the north-west corner of the university property and in the area of Ryniker Drive. Due to the large area of irrigated grass (the preferred larval host of JB) and location of positive traps, MSU-Billings has treated all University properties with Merit® 75WSP, a systemic Imidacloprid based insecticide. Additionally, the City of Billings has treated properties in the area including water holding facilities and parks. It is always the pesticide applicator's responsibility by law, to read and follow all current label directions for the specific pesticide being used.

In 2007, the first Japanese beetle found in Montana outside of the Billings area was detected in Lake County. An extensive delimitation survey by MDA personnel did not discover any additional adult JB in this area. This positive trap is currently believed to have been an isolated incident that resulted from human activity around the lake. The area will be closely monitored in the future.

The ERADICATION of this potentially widespread destructive pest in MONTANA will continue to be a COOPERATIVE EFFORT between federal, state, and local governments, as well as landowners and residents of the Billings area and the state of Montana.

Exotic Wood Borer and Bark Beetle
Cerambycidae, Scolytinae, Siricidae
Detection Survey

Wood boring insects are some of the most dramatically destructive invasive species that have been introduced into the forest and urban landscape of the US (e.g. Asian longhorned beetle, emerald ash borer). Some native wood boring insects (e.g. mountain pine beetle) also cause significant damage to Montana's forest resources, but the threat of exotic wood borers is significant for state tourism, recreation, and aesthetic beauty.

The Exotic Wood Borer and Bark Beetle (EWBBB) survey targets primarily three groups of insects; longhorned beetles (Cerambycidae), bark beetles (Scolytinae), and wood wasps (Siricidae). Within these groups more than 20 species are specifically targeted including the Asian longhorned beetle, Japanese pine sawyer, European spruce bark beetle, brown spruce longhorned beetle, and spruce engraver. This survey is conducted using Lindgren Funnel traps baited with various ultra high release (UHR) ethanols, bark beetle pheromones, and pine volatile lures. Funnel traps also have passive flight intercept capabilities, and the resulting trap catches include many native wood boring beetles and a wide range of non-target families. While not specifically target, Lindgren Funnel traps do capture beetles in the family Buprestidae and have the potential to trap exotic buprestids such as the Emerald Ash Borer.

In 2008, sixty-three funnel traps were placed and monitored across the state. Trap sites focused on businesses that import commodities from foreign countries that are often associated with solid wood packaging materials, recreation sites and campgrounds, and high traffic tourism areas.

Rhagium inquisitor (L.) the "Ribbed Pine Borer" and *Asemum striatum* (L.) are two longhorned beetles that are native to Europe but have long been established in North America. Both species are common in Montana conifer forests where they attack decaying conifer trees and are commonly caught in EWBB surveys.

RESULTS: No target species were collected.

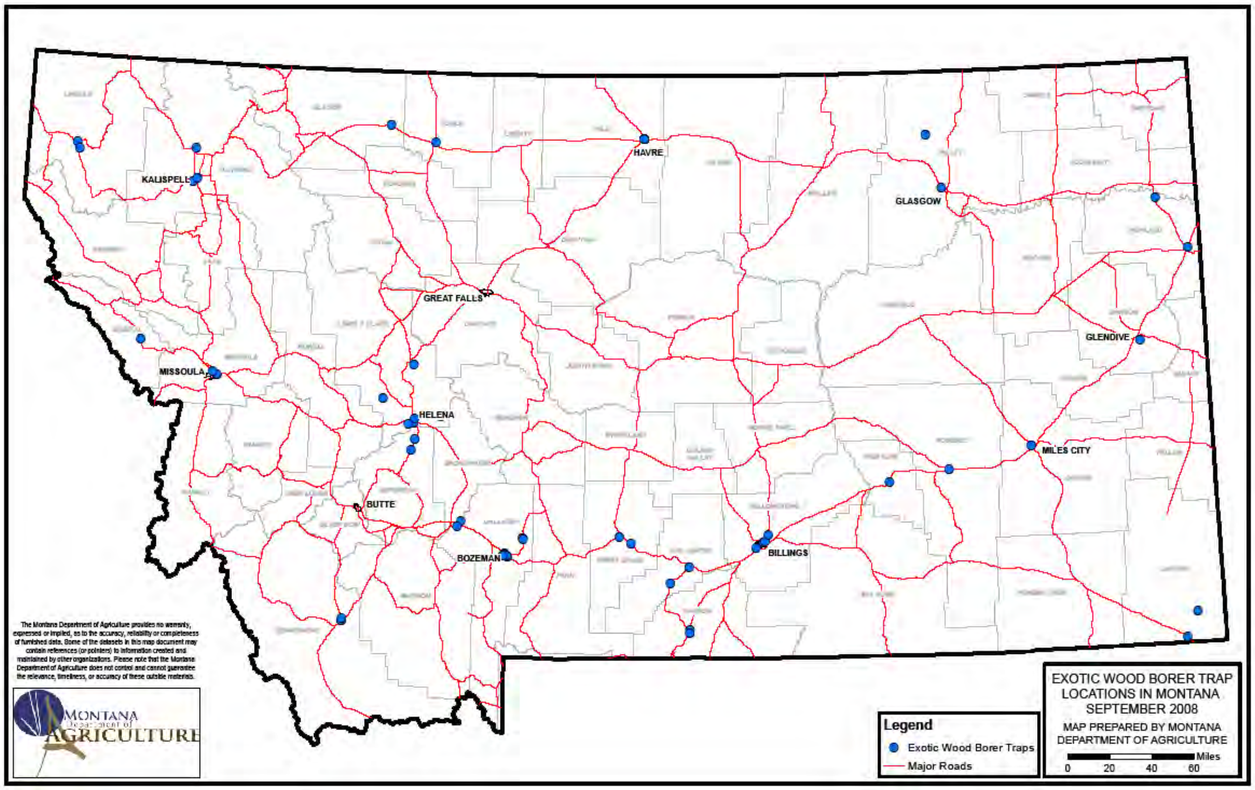
 

Urocerus californicus Norton (left) and *Xeris spectrum* (L.) (right). Images from Guide to the Siricid Woodwasps of North America, Nathan M. Schiff, Steven A. Valley, James R. LaBonte, and David R. Smith.

2008 MDA EXOTIC WOODBORER AND BARK BEETLE TRAPS BY COUNTY			
# of Traps	**County**	**# of Traps**	**County**
2	CARTER	2	CARBON
2	DAWSON	1	SWEETGRASS
6	YELLOWSTONE	1	PARK
1	TOOLE	6	LEWIS AND CLARK
4	FLATHEAD	3	JEFFERSON
1	FERGUS	6	GALLATIN
3	CASCADE	1	BROADWATER
2	CHOUTEAU	2	LINCOLN
2	McCONE	6	MISSOULA
2	RICHLAND	3	BEAVERHEAD
1	CUSTER	1	RAVALLI
1	ROSEBUD	1	MADISON
2	STILLWATER	1	SANDERS
		63	**Total**

The most commonly collected species of Cerambycidae were; *Asemum striatum* (L.), *Arhopalus productus* LeConte, *Monochamus clamator* (LeConte), *Monochamus scutellatus* (Say), *Neoclytus longitarsus* Casey, *Phymatodes dimidiatus* (Kirby), *Spondylis upiformis* Mannerheim, and *Tetropium velutinum* LeConte. The most commonly collected Buprestidae were; *Anthaxia inornata* (Randall), *Phaenops drummondi* (Kirby), *Melanophila acuminata* (De Geer), and *Buprestis maculiventris* Say.

Locations of EWBB traps placed in Montana by MDA



Four native species of Siricidae were trapped in 2008 (two are imaged above); *Urocerus californicus* Norton, *Urocerus albicornis* (F.), *Sirex cyaneus* F., and *Xeris spectrum* (L.).

Many species of scolytid bark beetle were trapped in 2008 including; *Ips pini* (Say), *Ips calligraphus* (Germar), *Hylesinus aculeatus* (Say), *Dendroctonus valens* LeConte, *Dendroctonus ponderosae* Hopkins, *Dendroctonus pseudotsugae* Hopkins *Orthotomicus latidens* (LeConte), *Pityogenes carinulatus* (LeConte), *Hylastes nigrinus* (Mannerheim), and *Hylastes gracilis* (LeConte). Several specimens of scolytid were determined by J. R. LaBonte with the Oregon Dept. of Agriculture.

In addition to the target families, at least 42 other families of beetles were recorded from traps. Those families included; Agyrtidae, Anobiidae, Anthicidae, Anthribidae, Atellabidae, Bostrichidae, Byrrhidae, Cantharidae, Carabidae, Cerylonidae, Chrysomelidae, Clambidae, Cleridae, Coccinellidae, Colydiidae, Cucujidae, Cupedidae, Curculionidae, Dermestidae, Elateridae, Endomychidae, Erotylidae, Histeridae, Hydrophilidae, Laemophloeidae, Latridiidae Leiodidae, Melandryidae, Melyridae, Monotomidae, Mycetophagidae, Nemonychidae, Nitidulidae, Phalacridae, Salpingidae, Scarabaeidae, Scraptiidae, Silphidae, Silvanidae, Staphylinidae, Tenebrionidae, and Trogossitidae.

Non-Target Woodboring Species Collected in 2008		
Family	**Common Name**	**Species**
Cerambycidae	longhorned beetle	*Asemum striatum* (L.)
Cerambycidae	old house borer	*Arhopalus productus* LeConte
Cerambycidae	longhorned beetle	*Centrodera sublineata* LeConte
Cerambycidae	pine sawyer	*Monochamus clamator* (LeConte)
Cerambycidae	pine sawyer	*Monochamus scutellatus* (Say)
Cerambycidae	longhorned beetle	*Oberea* sp.
Cerambycidae	longhorned beetle	*Neoclytus longitarsus* Casey
Cerambycidae	longhorned beetle	*Phymatodes dimidiatus* (Kirby)
Cerambycidae	ribbed pine borer	*Rhagium inquisitor* (L.)
Cerambycidae	longhorned beetle	*Tetropium velutinum* LeConte
Cerambycidae	longhorned beetle	*Xylotrechus undulatus* (Say)
Cerambycidae	longhorned beetle	*Spondylis upiformis* Mannerheim
Cerambycidae	longhorned beetle	*Euderces* sp.
Cerambycidae	longhorned beetle	*Anelaphus* sp.
Buprestidae	metallic wood boring beetle	*Anthaxia inornata* (Randall)
Buprestidae	metallic wood boring beetle	*Phaenops drummondi* (Kirby)
Buprestidae	metallic wood boring beetle	*Melanophila acuminata* (De Geer)
Buprestidae	metallic wood boring beetle	*Buprestis maculiventris* Say
Buprestidae	metallic wood boring beetle	*Agrilus politus* (Say)
Siricidae	woodwasp	*Urocerus californicus* Norton
Siricidae	woodwasp	*Urocerus albicornis* (F.)
Siricidae	blue horntail	*Sirex cyaneus* F.
Siricidae	woodwasp	*Xeris spectrum* (L.)
Curculionidae: Scolytinae	pine engraver	*Ips pini* (Say)
Curculionidae: Scolytinae	six-spined ips	*Ips calligraphus* (Germar)
Curculionidae: Scolytinae	bark beetle	*Ips borealis* Swaine
Curculionidae: Scolytinae	bark beetle	*Ips integer* (Eichhoff)
Curculionidae: Scolytinae	bark beetle	*Orthomicus latidens* (LeConte)
Curculionidae: Scolytinae	emarginate ips	*Ips emarginatus* (LeConte)
Curculionidae: Scolytinae	bark beetle	*Ips grandicollis* (Eichoff)
Curculionidae: Scolytinae	red turpentine beetle	*Dendroctonus valens* LeConte
Curculionidae: Scolytinae	mountain pine beetle	*Dendroctonus ponderosae* Hopkins
Curculionidae: Scolytinae	douglas-fir beetle	*Dendroctonus pseudotsugae* Hopkins
Curculionidae: Scolytinae	bark beetle	*Dryocoetes autographus* (Ratzeburg)
Curculionidae: Scolytinae	bark beetle	*Dryocoetes affaber* (Mannerheim)
Curculionidae: Scolytinae	bark beetle	*Trypodendron lineatum* (Olivier)
Curculionidae: Scolytinae	bark beetle	*Scierus annectans* LeConte
Curculionidae: Scolytinae	bark beetle	*Poityokteinos minutus* (Swaine)
Curculionidae: Scolytinae	bark beetle	*Scolytus unispinosus* LeConte
Curculionidae: Scolytinae	bark beetle	*Hylastes gracilis* LeConte
Curculionidae: Scolytinae	bark beetle	*Hylastes macer* LeConte
Curculionidae: Scolytinae	bark beetle	*Hylastes nigrinus* (Mannerheim)
Curculionidae: Scolytinae	bark beetle	*Hylurgops porosus* (LeConte)
Curculionidae: Scolytinae	bark beetle	*Pityogenes carinulatus* (LeConte)
Curculionidae: Scolytinae	bark beetle	*Pityophthorus* sp.
Curculionidae: Scolytinae	bark beetle	*Gnathotrichus sulcatus* (LeConte)
Curculionidae: Scolytinae	bark beetle	*Hylesinus aculeatus* (Say)

European Pine Shoot Moth (EPSM)
Rhyacoinia buoliana (Denis & Schiffermüller)
Quarantine Support Survey

Montana has had a quarantine for the European pine shoot moth (EPSM) since prior to 1962. This insect is a pest in the production of lumber, nursery trees and Christmas trees that are long-needled pines. Feeding by the larval stage in the growing tips causes death of leaders, resulting in trees with Y-shaped trunks, or other deformities, which are aesthetically unpleasing (lowering value in nursery and Christmas tree trade) or are not usable for major lumber markets due to a need for additional work to salvage merchantable trunks.

Adult European pine shoot moth, www.padil.gov.au

The insect itself is very small. The wingspan of the typical adult is under ¼ inch. However, the adult is very brightly colored, with orange and silver patterning on the wings. There are a number of native pine shoot moths with similar coloration, so identification is dependent on dissection of the male genitalia. The larvae initially feed in the tips of the branches in the new year's growth where they web the needles together for protection. Older larvae move to the needle sheath and mine into individual needles, after which they move on to the needle buds. They overwinter as larvae in the infested branch tips. Larvae emerge to feed again in the spring. This spring feeding is the most damaging, as it involves large larvae feeding on new foliage. The larvae pupate in the needle foliage in the tunnels and webbing they created while feeding. Moths emerge in mid-summer.

Monitoring for the EPSM is done using wing traps and species specific pheromones. These pheromones are attractive to the male moths, but female moths can also be caught in the traps.

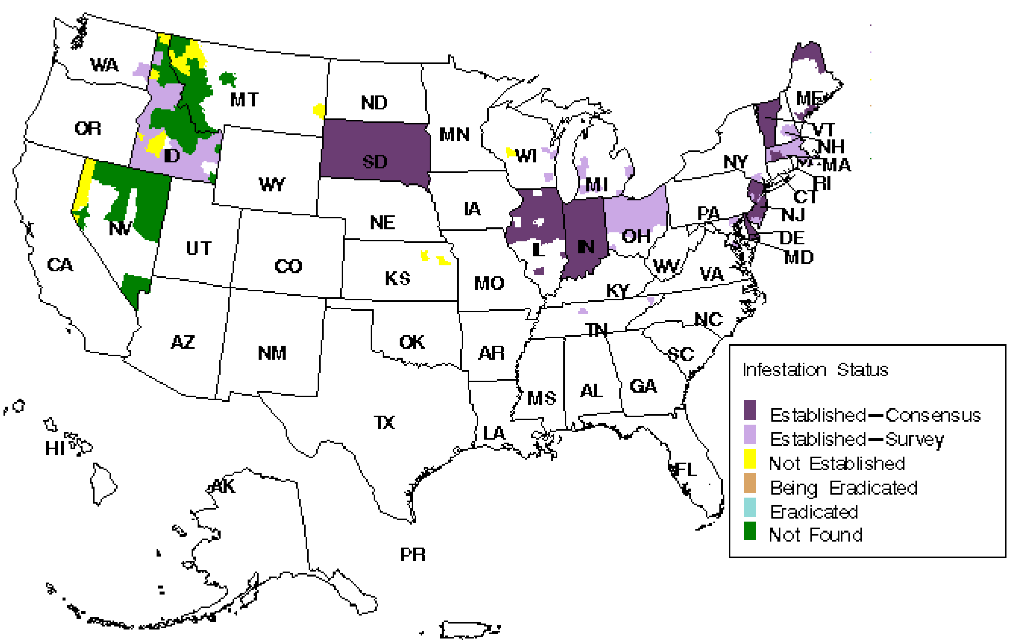
The majority of the areas of concern for EPSM are in the western portion of the state, west of the continental divide. This area is trapped each year for the presence of EPSM. MDA is responsible for exotic moth trapping in high risk counties west of the continental divide. This includes the following counties; FLATHEAD, GRANITE, LAKE, LINCOLN, MISSOULA, MINERAL, POWELL, RAVALLI, and SANDERS. There are several native tortricid species in the genus *Rhyacoinia* that occur in Montana.

Reported Status of

European Pine Shoot Moth(epsm) , Rhyacionia bouliana

in US and Puerto Rico

Data retrieved from National Agricultural Pest Information System on 04/11/2008

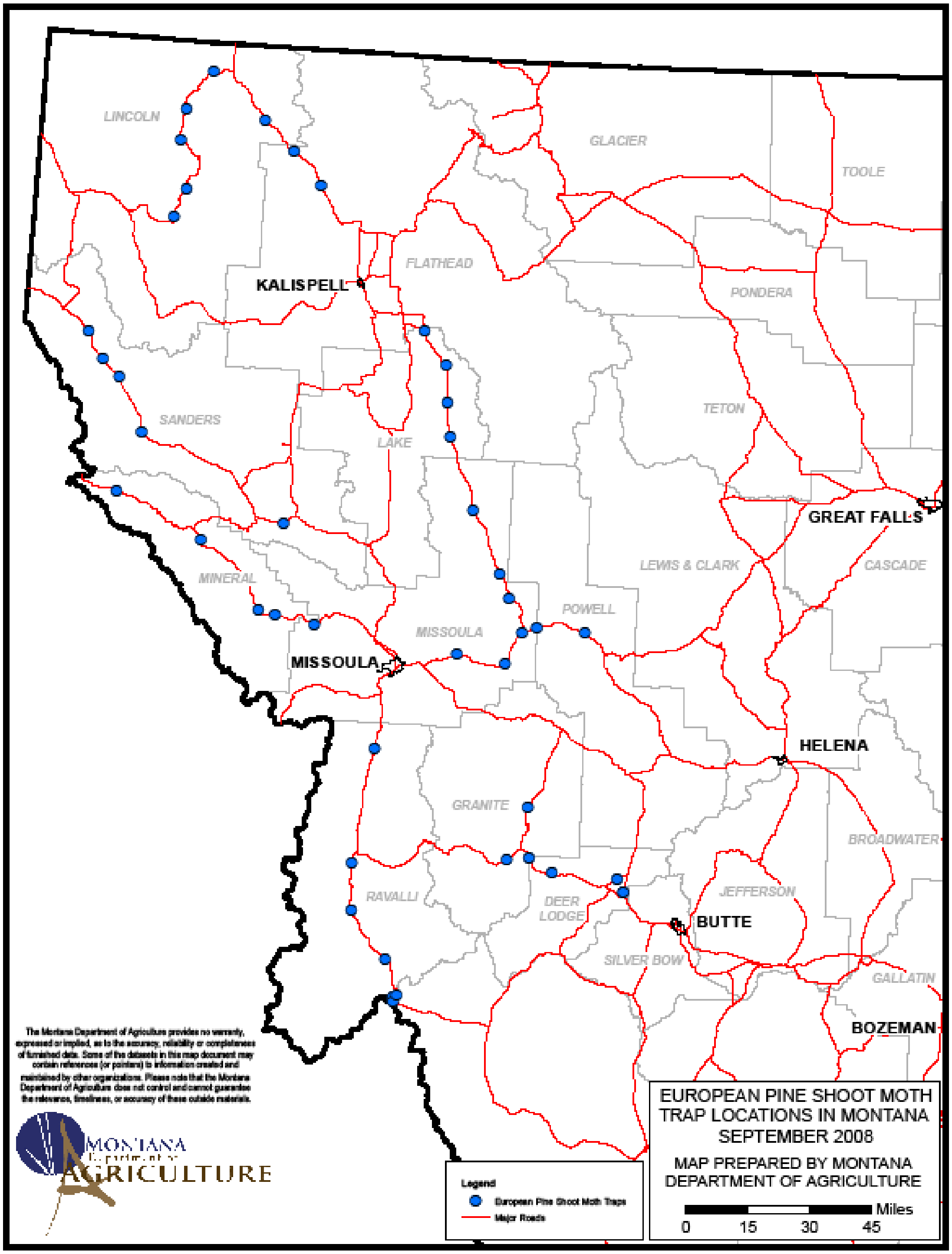


The Center for Environmental and Regulatory Information Systems does not certify the accuracy or completeness of the map. Negative data spans over last 3 years only.

2008 MDA EUROPEAN PINE SHOOT MOTH TRAPS BY COUNTY			
# of Traps	County	# of Traps	County
3	POWELL	1	SILVER BOW
7	MISSOULA	5	MINERAL
4	LAKE	11	SANDERS
7	RAVALLI	14	LINCOLN
2	GRANITE	10	FLATHEAD
4	DEER LODGE	3	LAKE
		71	Total

RESULTS: No traps were positive for EPSM in 2008. Several suspect moths were submitted to the USDA-SEL lab for identification, and were determined to be a Tortricidae species.

Locations of EPSM traps placed in Montana by MDA



Light Brown Apple Moth (LBAM)
Epiphyas postvittana (Walker)
Detection Survey

The first discovery of light brown apple moth (LBAM, Fig 1.) in the continental United States occurred in March of 2007 in the Bay area of California. This pest has been established in Hawaii since the late 1800's. LBAM is a native pest of Australia and has been introduced into India, New Caledonia, New Zealand, and the United Kingdom (CAB International, 2005). Currently, the entire state of Hawaii and the California counties of Alameda, Contra Costa, Marin, Monterey, San Francisco, San Mateo, Santa Clara, Santa Cruz, and Solano are all under a federal domestic quarantine order administered by the USDA. This quarantine has been established to prevent the dissemination of the LBAM and to establish restrictions on the interstate movement of certain regulated articles from the quarantined areas. LBAM could cause substantial economic losses to apple, grape, and pear crops if introduced throughout the continental United States. LBAM is highly polyphagous insect and would probably cause additional economic damage to other crops and sectors of the U.S. economy, e.g. domestic and international trade. Also, because LBAM can occur in nursery stock, this industry could provide another pathway for its introduction outside of the quarantined area in addition to movement on agricultural commodities.

Fig. 1. LBAM. http://www.tortricidae.com/lbam.asp

BIOLOGY (modified from LBAM National Survey Guidelines)

LBAM is a member of the moth family Tortricidae whose members are commonly called leaf rollers. There are generally two to four generations of LBAM per year across its native range (Wearing et al., 1991). Eggs are deposited in masses on the upper surface of leaves of smooth-leaved host plants. Early instars feed on tissue beneath the leaf surface on the underside of leaves inside self-constructed silken webs (Thomas, 1998). Larger larvae construct feeding niches between two leaves, a leaf and fruit, in the bud, or on a single leaf (Thomas, 1998). Larvae go

through five, six or seven instars. Pupation occurs within these rolled leaf sites. The larvae overwinter but do not undergo diapause. There is no available data on cold tolerance for LBAM, but there is potential that if populations or individuals are introduced in Montana the cold climate might prevent overwintering and permanent establishment of this pest. Since LBAM does not go into diapause at low temperatures, it is expected that lower temperatures will have a detrimental effect on the insect. Adults do not readily disperse out of favorable habitats (Danthanarayana, 1983) and only about 10% of the population migrates (Wearing et al., 1991).

HOSTS

LBAM has a host range in excess of 150 plant genera in over 70 families, including nursery stock, cut flowers, stone fruits, pome fruits, grapes, and citrus. Important plants in Montana on the list of "primary" hosts are cherries, apples, pine trees, potatoes, and alfalfa. In the state of Montana nearly1.6 million acres of hay alfalfa, 12,000 acres of potatoes and 2,000 orchard acres are planted or harvest annually. The sweet cherry crop averages around 2,000 tons of fruit production annually.

ECONOMIC DAMAGE

Damage is caused by larval feeding on the foliage, buds, shoots, and fruits of host plants (Wearing et al., 1991). Fruit damage has the greatest economic impact. The larvae feed mainly on the fruit surface, often where a leaf is tied to the fruit or between fruits, which causes the formation of large irregular blemishes (Wearing et al., 1991).

Jackson Trap, USDA/APHIS/PPQ

NATIONAL SURVEY

Starting in 2008, a national survey for LBAM was funded through USDA-APHIS-PPQ. This survey was designed to determine the potential presence of LBAM in other states including Montana, and to facilitate early detection, eradication, and or management of infestations. State survey levels were determined based on NAPPFAST risk modeling (Figs. 2, 3). Based on climate and land use criteria, Montana is categorized as "Low" risk for the introduction of LBAM. This designation recommends the placement of 50 LBAM traps monitored for 3 months. All traps and the female sex-pheromone based lure for LBAM were provided by

USDA-APHIS-PPQ. This survey had the goal of not only determining presence or absence of LBAM, but also establishing a framework within the state of Montana for conducting a similar survey in an emergency pest detection situation.

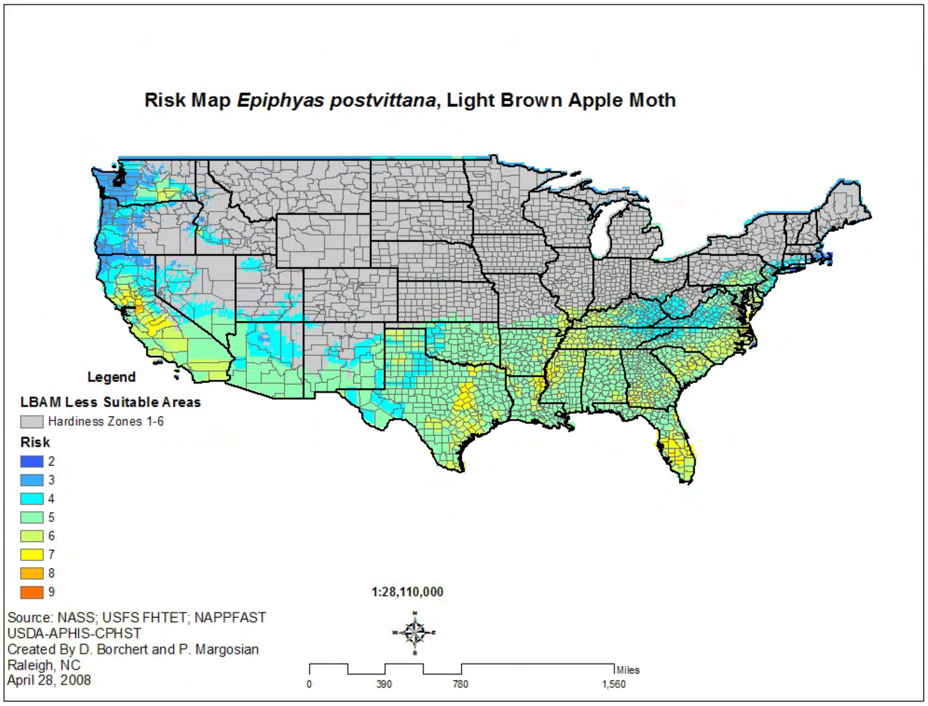


Figure 2. Risk Map for LBAM with all USDA Plant Hardiness zones.

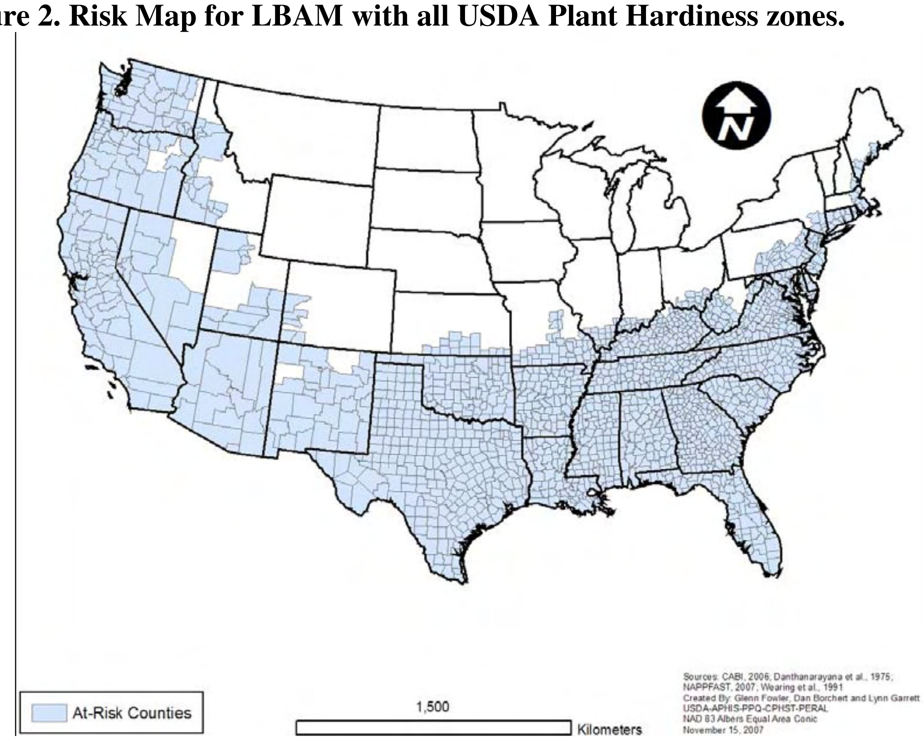


Figure 3. Risk Map for LBAM with USDA Plant Hardiness zones 7-10.

MONTANA SURVEY

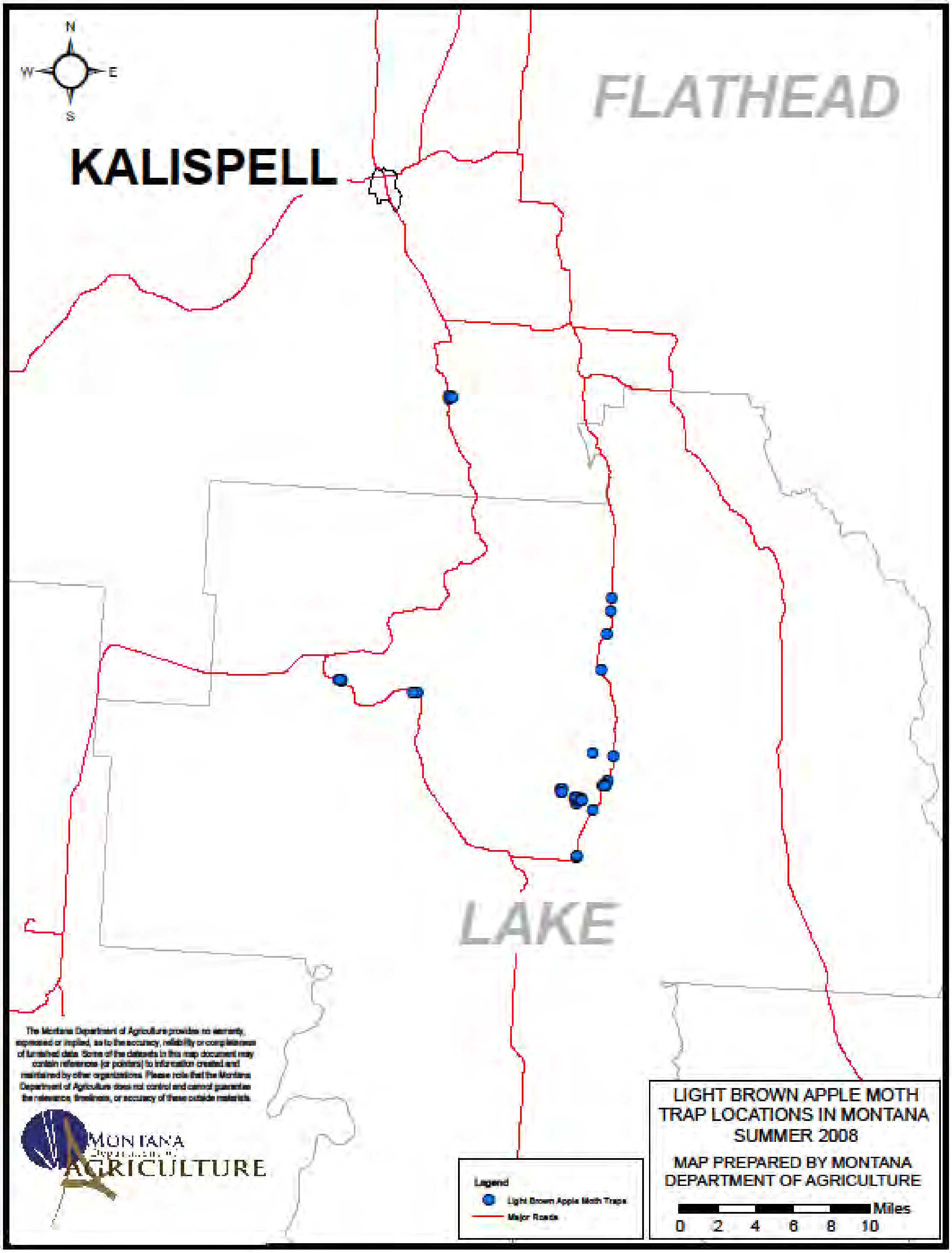
Survey protocols followed the 2008 Light Brown Apple Moth National Survey Guidelines (USDA 2008, http://www.aphis.usda.gov/plant_health/plant_pest_info/lba_moth) published by USDA-APHIS-PPQ. All traps and the female sex-pheromone lure for LBAM were provided by USDA-APHIS-PPQ. Survey planning, execution, and initial trap screening were completed by Montana Department of Agriculture personnel. *Jackson* type fruit fly traps were used by MDA and all traps were placed in the area around Flathead Lake. This higher risk area of Western Montana was targeted due to the fruit production that occurs there. Nurseries in that area were also targeted. All traps were placed in Lake or Flathead counties during the beginning of July; traps were checked once in August and then removed in September. All traps were screened for suspect moths by the MDA State Entomologist.

RESULTS

No light brown apple moths were caught by MDA personnel in 2008. *Adoxophyes negundana* (McDunnough) (image below) was the most commonly trapped suspect tortricid moth caught in LBAM traps in 2008.

Image of shimmering gold *Adoxophyes* moth

Location of LBAM traps placed in Montana



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Pulse Crop Nematode Survey

William M. Brown Jr., www.Bugwood.org
Howard F. Schwartz, Colorado State University

Damage to an alfalfa field caused by the stem and bulb nematode, *Ditylenchus dipsaci*.

Nematodes can cause dramatic reductions in pulse crop yields. The nematodes surveyed for are primarily of regulatory significance and could negatively impact our agricultural export markets if detected within Montana.

Damage caused by the pea cyst nematode, *Heterodera goettingiana* results in patches of stunted, bright yellow plants. Yellowing begins at the base of the plant with the older leaves and continues to move up the plant affecting the entire plant. Some of the affected plants may also die prematurely due to lack of chlorophyll. The roots of affected plants develop abnormally and nitrogen deficiency typically occurs due to a lack of nitrogen fixing nodules on the roots. As a result, seed production is also significantly reduced. The nematodes can persist for an extended period of time within the soil without a known host, yet cause significant damage when crops are planted again.

In an unfunded survey in support of the pulse crop industry, Montana Department of Agriculture employees collected 45 soil samples throughout Daniels, Roosevelt, Sheridan and Valley Counties. Crops represented in the samples included chickpeas, lentils, green peas, yellow peas and fallow fields.

Soil was analyzed for over thirty five nematode species, sixteen species of regulatory concern and nineteen other plant-parasitic genera, including: *Globodera rostochiensis, Globodera pallida, Ditylenchus destructor, Ditylenchus dipsaci, Meloidogyne chitwoodii, Meloidogyne fallax, Meloidogyne hapla, Meloidogyne javanica, Meloidogyne artiellia, Nacobbus abberans, Heterodera glycines, Heterodera latipons, Heterodera goettingiana and Pratylenchus* sp.

This information is important for Montana farmers in their management techniques and it also allows specific areas to be certified as free from some of these nematodes. This enables Montana producers to gain access to a wider agricultural export market for their crops. Montana growers plant over 500,000 acres of pulse crops (dry peas, dry beans, lentils, and garbanzo beans) annually, harvested crops are valued at over 50$ million. Montana pulse crops are exported to many Asian and Middle Eastern countries including China, India, Pakistan, Egypt, Nepal, and Turkey.

RESULTS:

2008 PULSE CROP NEMATODE SURVEY RESULTS		
Species of Regulatory or Economic Concern	**Group**	**POSITIVE/NEGATIVE**
Bursaphelenchus xylophilus (Steiner and Buhrer)	Pine wilt	NEGATIVE
Ditylenchus destructor Thorne	Potato rot	NEGATIVE
Ditylenchus dipsaci (Kühn)	Bulb and stem	NEGATIVE
Globodera pallida (Stone)	Potato cyst	NEGATIVE
Globodera rostochiensis (Wollenweber)	Potato cyst	NEGATIVE
Heterodera glycines Ichinohe	Soybean cyst	NEGATIVE
Heterodera latipons Franklin	Cereal cyst	NEGATIVE
Meloidogyne arenaria (Neal)	Root knot	NEGATIVE
Meloidogyne artiellia Franklin	Root knot	NEGATIVE
Meloidogyne chitwoodi Golden et al.	Root knot	NEGATIVE
Meloidogyne fallax Karssen	Root knot	NEGATIVE
Meloidogyne hapla Chitwood	Root knot	POSITIVE
Meloidogyne incognita (Kofoid & White)	Root knot	NEGATIVE
Meloidogyne javanica (Treub)	Root knot	NEGATIVE
Meloidogyne mayaguensis Rammah and Hirschmann	Root knot	NEGATIVE
Nacobbus aberrans (Thorne)	False root knot	NEGATIVE
Other Plant-Parasitic Genera	**Group**	**POSITIVE/NEGATIVE**
Anguina	Seed gall	NEGATIVE
Aphelenchoides	Bud and leaf	NEGATIVE
Belonolaimus	Sting	NEGATIVE
Cactodera	Cactus cyst	NEGATIVE
Ditylenchus other species	Other	POSITIVE
Helicotylenchus	Spiral	POSITIVE
Heterodera other species	Cyst	POSITIVE
Hemicycliophora	Sheath	NEGATIVE
Hoplolaimus	Lance	NEGATIVE
Longidorus	Needle	NEGATIVE
Mesocriconema	Ring	POSITIVE
Paratrichodorus	Stubby root	NEGATIVE
Paratylenchus	Pin	POSITIVE
Pratylenchus	Root lesion	POSITIVE
Quinisulcius	Stunt	POSITIVE
Rotylenchulus	Reniform	NEGATIVE
Trichodorus	Stubby root	NEGATIVE
Tylenchorhynchus	Stunt	POSITIVE
Xiphinema	Dagger	POSITIVE
Merlinius	Stunt	POSITIVE

All samples were processed in the lab of Dr. Thomas O. Powers at the Department of Plant Pathology , University of Nebraska.

Meloidogyne hapla Chitwood, the northern root knot nematode was detected in a single sample. The northern root knot nematode affects many species of vegetables and weeds and can cause significant economic damage. *Heterodera trifolii* (Goffart), the clover cyst nematode was detected in several samples at levels that are probably causing economic damage for pulse crop producers. Other plant parasitic genera that were detected were not found if high enough numbers to indicate that they are causing yield losses. Typically, genera such as *Paratylenchus* and *Quinisulcius*, only are injurious to crops when numbers approach 500-1,000 individuals per 100 cc of soil.

Pea field in Northeastern Montana.

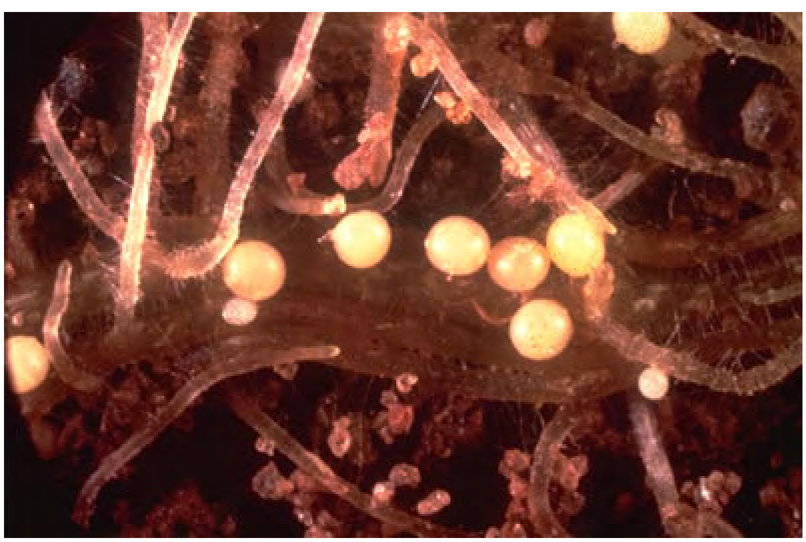
Potato Cyst Nematodes
Globodera pallida (Stone) & *G. rostochiensis* (Wollenweber)
Detection Survey

INTRODUCTION

Montana is a supplier of seed potatoes for much of the Pacific Northwest. Because of this, it is imperative that the quality of Montana's potatoes, and their reputation, be maintained. Recently, *Globodera pallida* was found in Idaho, in commercial potato fields. In the aftermath of this find, several trading partners closed their doors not only to Idaho potatoes but also to other crops including nursery stock, and sampling to determine the extent of the infestation is still ongoing. If this organism were discovered on seed potatoes from Montana, there is a real possibility that it would destroy the seed potato industry. The Montana potato industry plants over 10,000 acres annually with crops valued at over 30$ million.

Shortly after this find, producers in Alberta (Canada) found golden cyst nematode (*Globodera rostochiensis*) in fields. This initiated international action again, with subsequent trace-forward action involving a Montana field.

The presence of either of these organisms in Montana would have devastating impacts on the seed potato industry. Action can be taken now to 1) systematically determine if these pests have invaded Montana and, 2) shield the potato industry by creating an internal quarantine system, so that if potato cyst nematodes were found in any area of the state, the remaining production areas could continue to ship.



Globodera pallida cysts, www.eppo.org/

Globodera rostochiensis cysts, www.eppo.org/

PLAN OF ACTION

A statewide survey of seed potato producers was developed to adequately represent and sample potato production areas. Survey's in 2008 were conducted in several counties with potato crops identified as economically important to Montana's export markets. The counties sampled in 2008 were Beaverhead, Gallatin, Madison, and Sheridan.

Samples were collected using USDA protocols. Each sample consisted of five pounds of soil per acre of crop in field that were just harvested from potatoes. Data collected included date of collection, collector, potato variety, seed generation, and field number.

RESULTS

Twenty-six grower operations were sampled for a total of 1,480 samples. Sample processing is ongoing. This survey is planned to continue in the spring, prior planting.

Status Report
Japanese Beetle Trapping

Billings, Montana 2008

Japanese beetle (JB) adults continue to be found in Billings, MT. Adults were found in several traps baited with both male sex pheromone and floral scent lures during the 2008 delimiting survey. Treatment of turf grass and other irrigated areas within a one-mile radius circle of land commenced in previous years. All treatments were on a voluntary basis. Roughly half of the land within the circle is extremely dry (less than 6 inches of precipitation per year, primarily in the form of snow), and about half of that land is actually part of the “Rimrocks” proper, a series of sandstone cliffs ranging from five to over 50 feet high.

JB trap between Leavens Pumping Station and Rimrocks. Trap was positive for JB in 2008

Within the circle there are about 650 properties. A large portion of this land is owned by Montana State University-Billings. Other major landowners include the City of Billings, and the airport, both of which were notified of past beetle finds, and appropriate courses of action. The airport added white grub control to their regular landscaping maintenance. At this time, the city was unable to include treatments of their land into regular property maintenance. Appropriate to the location of repeated positive traps, most Montana State University-Billings properties continue to be treated with Merit WS 75, including a large number of rental properties. MSU-Billings personnel trapped the same locations in 2008 as they trapped in 2006 and 2007. While homeowners no longer participated in the survey, the essential area, on the north-west corner of the University property and in the area of Ryniker Drive, was still trapped by MDA. This area has yielded over 95% of the JB collected in Billings over all years since initial detection.

During 2008, 54 JB traps were placed in the immediate vicinity of the MSU-B area. Eight traps were positive for JB with a total catch of 97 individuals on the universities property and nearby private property. Many of these areas were treated for JB in 2008. This is a near tripling of the total number of beetles caught in any of the programs previous years.

The well irrigated turf at the city owned Leavens Pumping Station. This image was taken directly across the street from the JB trap that yielded more than 50 beetles.

Potential JB feeding damage in unmaintained area between Leavens Station and Rimrocks.

Aerial view of positive trap locations in the MSU-Billings area. Numbers in white indicate the number of adult JB caught in the traps.

JB Other Locations in Montana, 2007-2008

Following a find of JB in Lake County during 2007, a delimitation survey was conducted that year which yielded no additional JB finds. In 2008, 2 male Japanese beetles were found in a trap at a nursery in Flathead County. In 2009, a delimitation survey of nearly 500 traps will be conducted around the positive trap to determine if JB is present in Flathead county, or if the two individuals "hitchhiked" on a nursery shipment from an infested state. Traceback and trace-forward information will be collected to identify potential sources of JB material.

Japanese Beetle Trapping
USDA APHIS PPQ
MONTANA AIRPORTS
2008

The USDA APHIS PPQ traps for Japanese beetles at selected high risk airports within the state. Based on airport size, and number of flights from infested areas, traps are placed around the perimeter of the airports, and in any landscaping that might increase risk of JB infestation.

During 2008, the USDA APHIS PPQ placed and monitored 66 traps at seven airports. These were Billings (29 traps), Bozeman (5 traps), Butte (5 traps), Great Falls (12 traps), Helena (5 traps), Missoula (6 traps), and Kalispell (4 traps).

There were no detections of JB during the 2008 season in traps monitored by the USDA APHIS PPQ.

Montana Department of Agriculture 2008 Pest Survey
Internship Final Report
Jamie E. Hollett
September 1, 2008

Introduction

Many people take for granted the splendid spoils we receive from nature. Many of the simple pleasures we experience in life are threatened without us recognizing it. Simple things like enjoying the shade trees as we stroll down a side walk, having a lunch break in gorgeous park on a nice spring day, or listening to the rustle of leaves when the seasons begin to change. Can you image what life would be like without these simple, but wonderful pleasures? While working as an intern for the Montana Department of Agriculture this summer, I learned the importance of monitoring for exotic insects to protect against the loss of our trees and destruction of our breath taking landscapes in the great state of Montana.

As an intern for the Pest Management section, I participated in the Cooperative Agriculture Pest Survey program (CAPS). This program was designed for state and federal agencies to collaborate against the invasion of exotic pests. Early detection and monitoring are a large part of controlling exotic pests. To do this, requires interns, like me, to go out in the field and conduct surveys for different pest species. This summer I was assigned two surveys; the Exotic Wood Borer survey and the Emerald Ash Borer survey.

Exotic Wood Borer Survey

Over the summer I placed 56 Lindgren funnel traps through out Montana. These collapsible traps create a funnel for insects to get caught in and fall into a cup filled with a preservative. Every two weeks I collected samples from the cup of each trap, refilled the cup with preservative, and preformed any necessary maintenance to the traps. The traps were baited with a combination of lures to attract several different species of insects. The lures emit scents that resemble pheromones insects are attracted to. The traps were placed near plant nurseries, lumber yards, fishing accesses, trailheads, and other outdoor recreational areas. These locations are where the introduction of an exotic wood borer insect is very probable.

Photo I. Foley **Lindgren funnel trap**

Several different species of wood boring insects were targeted by these traps. The target list included six species of long horned beetles, four species of bark beetles, four species of pine bark beetles, Emerald ash borer, and Sirex wood wasp. Exotic wood borers are a serious threat for several reasons. Exotic wood boring insects are not welcome guests to trees. Many of them feed on the trees bark and leaves. Some drill holes and tunnels inside the trees cutting off nutrient supplies from their roots. Other insect species lay their eggs in trees and weaken the trees defenses against disease and/or actually spread diseases. Also, a large part of Montana's economy relies on tourism, agriculture, and wood products. Montana is a popular outdoor recreational state. If it were invaded by tree destroying insects the trees could be wiped out and the landscape could drastically change to a less appealing face. Montana would become a less desirable state to live in and visit.

Asian Long horned Beetle
www.columbia.edu/.../inv_spp_summ/alb1.bmp

Red-Haired Bark Beetle
www.ipm.ucdavis.edu/NEWS/IMAGES/barkbeetle.jpg

Pine Bark Beetle Infestation
lh5.ggpht.com/_31fTXwEnAUs/SIurezZaCNI

Emerald Ash Borer Survey

Agrilus planinpennis Fairmaire, the Emerald ash borer (EAB), is an exotic wood boring insect that attacks ash trees. Adult beetles are a metallic green color. They are 3/8 - 1/2 inch in length and 1/16 inch in width. Adults are rounded in the midsection and flattened towards the rear. Over the summer I placed one to seven EAB traps in almost every town in Montana along the major highways. Total, I placed 117 sticky purple traps. The traps were hung from the branches of ash trees, usually located along sidewalks or in town parks. Ash trees are not native to most of Montana, but they were and still are, used for town and city beautification. Only in the far south eastern corner of Montana, around Alzada, do they grow naturally. The trap's design is a sheet of purple cardboard like material that has a glue coating on one side. The sheet is folded into a triangle shape with the sticky coating facing out, and is then attached to a hanger. A plant volatile scented lure is then hung in the center of the trap. After hanging about thirty of these traps I finally worked out a technique that minimized the amount of sticky gunk I got on myself. Gloves were useless because they just stuck to everything and slid off.

Emerald Ash Borer Trap
dnr.wi.gov/forestry/fh/images/EABpaneltrap.jpg

Adult Emerald Ash Borer
www-personal.umich.edu

The Emerald ash borer is a nasty insect that has caused significant damage in the eastern two thirds of the United States. It is believed that the insect was brought to America in wooden shipping crates around 1998-1999. Originally from Asia, this insect preys on both healthy and stressed ash trees. Millions of ash trees have already been destroyed and more are dying. Emerald ash borers use the trees for reproducing. EAB larvae are creamed colored and grow to be 1.5 inches long. Clear indications that an ash tree has been infected with EAB larvae are the squiggly tunnels that can be found on the inside of the tree's bark. These tunnels cut off the nutrient supply from the trees roots causing crown diebacks. Vertical splits can be seen in the bark where larvae galleries cause callus tissue to develop. Also, at maturity, the insect bores D shaped holes in the trees as they chew their way out from under the bark. Epicormic sprouting at the base of an ash tree is another sign of EAB infestation. Once a tree has been attacked it has only has about 3 years to live.

D Shaped Exit Hole
www.vil.lisle.il.us

Emerald Ash Borer
www.thurston.unl.edu

EAB Larva
www.nps.gov

Larval Galleries
whatbugsme.org/pics/eabgalleries.jpg

EAB Damage to an Ash Tree
www.michigan.gov/images/mda_Declining_Ash

Results

The results for the exotic wood borer survey are still being examined. Thus far, no targeted species have been found. What I did find a lot of was *Monochamus clamator* (LeConte), Spotted Pine Sawyer beetle. They are a common urban pest in Montana. Also, many *Neoclytus longitarsus* Casey and *Phaenops drummondi* (Kirby) were found.

The results from the Emerald ash borer survey are not complete. Traps are still being checked and taken down. Thus far, no traps have been found positive for Emerald ash borers. I collected a few samples of metallic green colored insects from the traps over the summer, but none of them were Emerald ash borers.

Prevention

It is important for residents, businesses, and visitors to the state, to be aware of how these invasive insects affect our lives and how they are spread. It is not just the job of the federal and state agencies to deal with these issues. Everyone can help prevent the spread of unwanted insects. The general public can help by having a common knowledge of which insects are welcome in Montana and which aren't. Businesses need to be aware of the possibility of exotic insect introduction and only import from vendors who have a pest free certification. Tourist's and campers can help by not transporting firewood especially from other states, cleaning their chairs, tents, and equipment well before leaving a camp site, and by washing cars, trucks and R.V.s frequently so that insects, eggs ,or larvae are not carried around.

Conclusion

Working as an intern for this summer has been a great experience. I am now aware of how important agencies like the State Department of Agriculture are. Before this job I knew nothing about exotic pests and the damage they can do. Through internship programs like this one, students, professionals, and the public at large can learn about and prevent the loss of habitat that is so critical to Montana's future. Aggressive recruiting and funding of these and similar programs are essential to the future profitability and sustainability of Montana's Agricultural and outdoor recreation industries. As evidenced by our recent brush with brucellosis in cattle, neglecting MDA programs can have serious environmental and financial impacts on an already struggling economy.

Tips for Future Interns

Always have bug spray and sun tan lotion. To get the sticky glue from the EAB traps off your hands rub dish soap on dry hands then rinse. Wear old cloths. The sticky goo from the EAB traps does not come off cloths easily. Fill your gas tank every chance you get. You never know when you will see a gas station again. I recommend audio books for long trips. Bring your camera. Most of all have fun! Stop and check out places. Montana is a huge state with lots of interesting things to see and do.

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Montana Department of Agriculture Pest Survey 2008
Kelsey Redmond
October 15, 2008

INTRODUCTION

For the summer of 2008, I interned for the Montana State Department of Agriculture; setting up and observing over three hundred plant pest traps throughout the state in counties west of the continental divide. I monitored four exotic moth species: the gypsy moth (GM), rosy gypsy moth (RGM), European pine shoot moth (EPSM), and summer fruit tortrix moth (SFT).

As part of the Cooperative Agricultural Pest Survey (CAPS), federal and state agencies conduct surveys in order to recognize early invasions of these species that are not native to Montana. These species hold significant danger to Montana's ecosystems and agricultural industries. By putting specific pheromone for each species in traps, we are able to see if any pests are in the area. The GM and the RGM used the same trap with different pheromone and the EPM and the SFT used the same trap with different pheromone.

GYPSY MOTH: *Lymantria dispar*

In 1869 Leopold Trouvelot brought the gypsy moth from Europe to Massachusetts in an attempt to breed the moth for silk production. Eventually some of the larvae escaped from his lab and in the early 1900's, the species began to cause major defoliation in New England. In 1932, the gypsy moth was discovered in Pennsylvania. They soon spread to multiple counties in Pennsylvania and eventually to other states as well. Today the gypsy moth is found in many western states. These pests are spread by recreation activities and human transportation. Many people are unaware they are spreading this pest and are not informed to inspect outdoor items when traveling.

In areas where the gypsy moth is invading, the moth can destroy ecosystems by defoliating a host tree. These insects are responsible for over 10 million defoliated acres each year. Although the actual moth causes no harm, the larva causes the defoliation. Unfortunately, the GM has no predators in North America so controlling invasions can be very strenuous.

Female and male Gypsy moth.

Rosy Gypsy moth.

Gypsy moth larva.

EURPOEAN PINE SHOOT MOTH: ***Rhyacionia buoliana***

The European pine shoot moth was first detected in Long Island, New York in 1914. An infested nursery stock imported from Holland is where the pest is thought to have come from. In just one year, nine states were infested with EPSM. Today EPSM can be found in Oregon, Minnesota, Washington and Canada. The larvae can cause damages such as distorted growth, needle damage, and damage or death of buds and shoots. If the buds survive the larva's damage, it can grow into an S shape (see picture below). This pest is extremely threatening to pine nurseries and Christmas tree plantations.

Male EPSM


Damaged by EPSM

SUMMER FRUIT TORTRIX MOTH: *Adoxophyes orana*

The summer fruit tortrix Moth is threatening to rosaceous plants, mainly to apple and pear. The larvae feeds on the leaves and fruit. This moth has been known to feed on more than 50 species in fruits and forest trees. It is difficult to measure the economic impact of the summer fruit tortrix moth because it often occurs in mixed populations with other related species and can result in actions of secondary pests.


SFT larva


SFT

CONCLUSION

When I applied for this internship I didn't even think about what would happen if I got it. I've driven over 15,000 miles this summer and got to see a large amount of Montana country west of the continental divide. I learned a lot about traveling alone and answering your own questions when you have no cell service. Being able to pick your own hours is a great thing to be able to do during the summer. By the end of the summer, I knew my way around and I never had to use my map. Here are some recommendations for next year interns:

If your car doesn't have a cup holder, a role of duct tape does wonders.

It saves you a lot of frustration and time if you put your traps together before you leave town. Putting together four traps at every stop can be very tedious.

Before you leave town, make sure you have all the equipment that you will need. It can be frustrating if you leave town and you're missing a key tool for this job.

Keep in mind that the areas where you set up traps can change over the summer. Hang it up where it is easy to get down. If you are afraid of snakes, don't hang the trap up where you might have to walk through tall grass at the end of the summer. If there is a big snow bank, don't walk on top of it and hang up the trap. Also, try to keep traps to where you know someone can reach it, because you may not be the person picking up the traps at the end of the summer.

Keep all receipts and stay organized.

Always make sure you have enough sharpies and pens.

Always wear pants and a hat helps too.

Make sure you have enough gas before you leave town. It doesn't hurt to fill up even when you aren't empty.

Fortunately, I had good hotel experiences all summer. The only hotel I really had a problem with was in Eureka. They have you check out the room through a gas station next door. I wouldn't recommend staying there.

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Massachusetts Department of Agricultural Resources. 15 Oct. 2008
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Montana Department of Agriculture 2008 Pest Survey
Internship Final Report
Shane W. Delzer
August 22, 2008

Working for the Department of Agriculture's CAPS program has been an amazing experience. The first day I walked through the door I knew I would enjoy working here. The summer has been filled with many interesting events and adventures with the Department. From territorial land owners to getting lost, my summer was less then mind-numbing. Traveling up to Kalispell several times this summer has been exciting. I encourage everyone to go swimming in Flathead Lake when in the immediate region it never hurts to unwind with a nice swim.

Never forget to bring a couple extra pens because one of those days when you need one the most it will be missing. Always have a backpack with you to carry the things you need around. By no means trust your "gut" feeling when trying to find a certain places. I ended up going out of White Sulphur Springs with the intention of ending up in Helena. Three hours later after traveling on a sketchy dirt road I ended up in Cascade, two hours from my original destinations. Of course the views were great but the whole time my "gut" said I was going to come over the rise and end up in Helena.

Watch out for those extremely territorial land owners. I've only had a single run in with one, but it was enough to make me not to want to have an experience like that everyday.

Even though I've lived in Billings for three years it is still extremely confusing to drive in. I suggest one uses there GPS as much as they can when trying to find traps there. When searching for someone else's traps the best way is to look in the most inconspicuous place. In essence look for a place you wouldn't have put it and that's most likely where it is.

Always gas up when traveling even if you have half a tank and always pay attention to the amount of gas you have. I was trucking down U.S. 93 oblivious to my gas situation when all of a sudden an annoying ding comes on. My first reaction was to make sure I was buckled, when that wasn't it however, I looked at the dash. Of course the gas light was on and I was below empty. Only because I have luck on my side was there a gas station in the middle of no where that I was able to gas up at.

Working for the Department of Agriculture has been a blast and the most interesting job I've had. I have greatly increased my knowledge of the pests and noxious weeds that effect Montana's agriculture. What I've learned has made me less ignorant to the jeopardy that Montana's farms and forests are in. It has also helped me to polish up my problem solving skills as well as my communication skills. I thank my supervisors Patricia Denke and Ian Foley for the chance to work with them. I also would like to thank the Department of Agriculture for hiring me on for the summer. It has been an experience that will be carved in my memory forever.

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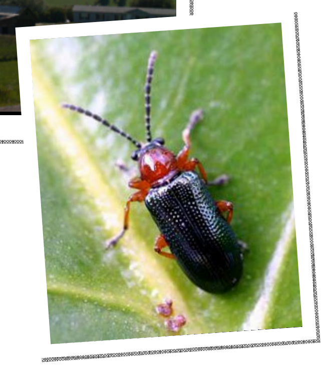
Internship Final Report
April Wabeke
August 22, 2008



Cereal Leaf beetle History

The cereal leaf beetle (CLB), *Oulema melanopus* is a dangerous pest that consumes grain plants such as wheat, barley, oats, corn and other small grains.

The CLB will overwinter in various places such as field debris, soil, inside of bark crevices, in the crowns of grasses, and other similar places. Shortly after mating, the female may lay 150 eggs to 400 eggs on the upper surfaces of the grain leaves. Depending on the temperature of the atmosphere, the eggs can take from 4 to 23 days to hatch (6).

In time they will move into the soil to pupate, emerging as adults. After feeding for about 2 weeks or so on cereal crops, the adult beetles will go into summer hibernation. Later on they will seek out shelter to pass the winter.

The CLB has become a serious pest of small grains in the Mid-Atlantic region of the

United States (5). The beetles originally came from Europe and Asia. It was first found in Michigan in 1962; from there it spread to the other neighboring states. Once it was found, a large-scale eradication program was conducted by the U.S. Department of Agriculture (USDA) and cooperating states from 1963 to 1969. It was unsuccessful (1).

As far as Montana goes, cereal leaf beetles were not established in Montana until the mid to the late 1980's. Then later on in about 1992 parasitoids were released by PPQ, the parasitoid that was released was *Tetrastichus julis*.

In 1993, PPQ began releasing the egg parasite, *Anaphes flavipes*. In 1995, there were positive results starting to happen from the releases of the parasitoids. 1999 was the last year that there were releases of the CLB parasitoids. In 2001 there was an agreement made with a private producer to start an *Anaphes flavipes* insectary and in 2001 it opened for business.

From 1964 to 1970, USDA's Agricultural Research Service imported some of the CLB's natural enemies to keep the beetles from spreading further. By the early 1970's there were four species of natural enemies that were found and established in Michigan and Indiana. As a result of this program, the natural enemies of CLB's were spread, with the parasitoids being released in many sites, and the CLB populations have decreased substantially.

What they look like

The eggs of CLB are yellow when they are first laid and they darken before hatching. The eggs are laid on the upper surface of plant leaves, and are about the size of a pinhead.

The larval stage is the most damaging stage of this particular insect; even though the adults will feed on the plants. They graze on the upper leaf surface as they feed. The smaller larvae will feed mostly between the leaf veins, this results' in long, narrow slits in the leaves. The larvae have a black head and yellow body and sometimes the yellow color is not visible. This is because they often cover themselves with their own fecal material, which can be rubbed off onto your clothing or your skin.

Adult CLB's are 3/16th of an inch long and they have a metallic blue head and wing covers, with a red pronotum (neck) and orange-yellow legs (2).

Damage they cause

Damage from CLB is very apparent, the tips of the leaves of plants turn a whitish color, from where the beetle consumed the chlorophyll. "The beetles consume the chlorophyll containing mesophyll cells, leaving the translucent lower leaf cuticle intact."(1). Extensive damage caused by these insects looks frosted. These particular beetles do not like hot temperatures and they preferred cool moist areas. CLB's not only like wheat, barley, oats, and new corn shoots, but they are also found on rye, millet, rice, and many other types of wild grasses.

Cereal Leaf Beetle Parasitoids Cereal leaf beetles are being controlled by a natural process other than pesticides. They are being controlled by their natural parasitoids, which are a biocontrol method and a safer and more cost effective way to control this pest.

One of the cereal leaf beetle parasitoids is called *Anaphes Flavipes* and it belongs to the order Hymenoptera, and the family Mymaridae. They are also known as fairyflies. Members of the family Mymaridae are all parasites of other insect eggs. These insects have a number of host species that include the orders Odonata, Orthoptera, Psocoptera, Thysanoptera, Hemiptera, Coleoptera, Lepidoptera, and Diptera. *Anaphes flavipes* are distinguished from other insects by a series of unique sulci on the head, a set that is parallel to the inner edges of the compound eye on the frons and vertex. They also have a distinctive sulcus extending across the eyes and are above the place where the antenna is inserted. Many of the species are differentiated by the stalked, parallel-sided hind wings and the narrow base of the front wings. These insects are very small; they are usually less than one mm in size. Unfortunately, they are poorly known, but they are a common and are a distinct component of most insect environments.

A second parasitoid of the Cereal Leaf Beetle is *Tetrastichus julis* and it belongs to the order Hymenoptera and the family Eulophidae. The Eulophidae are a very large group of insects of which includes more than 500 different described North American species. These insects are really small; they are about 1-3 mm long. *Tetrastichus julis* are parasites to a wide variety of hosts, including a number of major crop pests. The crops can include: wheat, barley, and oats. This species mostly parasitize either the egg or the larva of the host insect they are attacking. They also have axillae (armpit) that extend forward beyond the tegulae which is a scale-like lobe at the base of the forewing. Most of these insects are brightly metallic looking in color, and many males of this species have pectinate (tooth-like) antennae.

Biocontrol is an important aspect of agriculture production in that it is more effective, cheaper for producers, and less harmful to the environment. Biocontrol works because it uses carefully selected natural enemies that are tested before they are released to help control the pests. They are also more effective because they can travel and move about to other locations. A biocontrol program is beneficial in that it has a longer control over the pests being managed. The costs are also lower overall, and the effects are much greater for years rather than in a short period of time with pesticides. Once the biocontrol organism is established, the relationship between the parasitoid and the pest has corresponding population numbers in which the pest is being successfully controlled.

I sampled 23 counties Hill, Yellowstone, Carbon, Bighorn, Sheridan, Daniels, Roosevelt, Richland, Dawson, Prairie, McCone, Chouteau, Blaine, Valley, Phillips, Liberty, Toole, Teton, Meagher, Wheatland, Judith Basin, Fergus, and Flathead. Of the counties that I had sampled I had only found cereal leaf beetles in four counties. They were found in Yellowstone, Carbon, Bighorn and Richland counties.

2008 Results

County	CLB Adult	Larvae	Parasitoids
Yellowstone	**87**	**3**	**Yes**
Carbon	**1**	**0**	**No**
Big Horn	**3**	**3**	**No**
Richland	**1**	**11**	**Yes**

In conclusion, the data for this year has revealed that parasitoid activity in the CLB larvae appears to be effective in reducing the numbers of adult CLB's. While it is not possible to determine all possible factors resulting in these totals from the last two years, it does lead me to believe that the parasitoids are effective in reducing the number of larvae.

Bibliography

Photos:
Mountains taken by April Wabeke
Cereal Leaf beetle:©Entomart
Parasitoid: USDA, APHIS, PPQ
Grain of Wheat: by April Wabeke

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